# THE ELECTRICAL REVIEW

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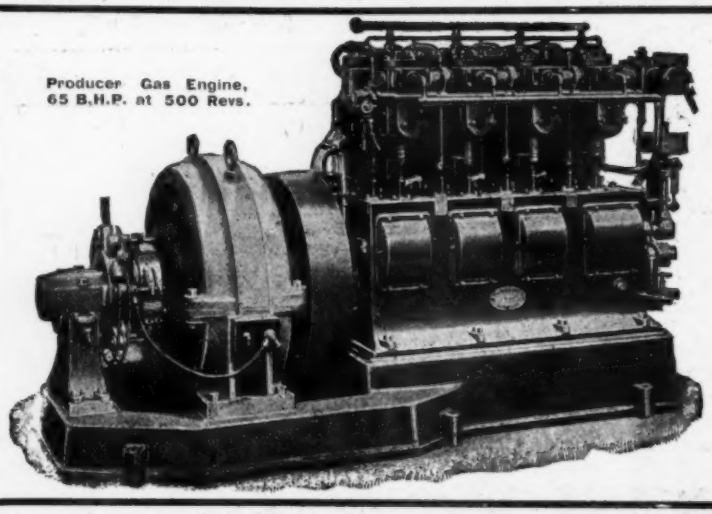

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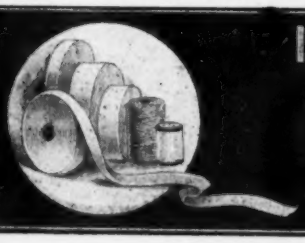

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## AN AMERICAN CONVENTION.

WHILE we on this side of the Atlantic have been compelled this year to abandon summer conventions, public dinners, and other functions which in the ordinary course provide those opportunities for relaxation and fraternisation which go so far to sweeten professional and trade relations, events of this class seem to have been taking place very much as usual in the United States.

Indeed, from the American electrical journals lately received we gather that the May convention of the National Electric Light Association in Chicago was not merely "as usual," for it is described as the greatest convention the Association has ever held, great in point of numbers, but greater "in point of accomplishment." It seems that a spirit of optimism swayed the minds of many hundreds of central-station leaders, their associates, and affiliated interests.

We confess to something akin to envy, as we regard the periodical doings of the N.E.L.A., and remember our own failures to bring all similar electrical interests in the United Kingdom into like fellowship. It is but natural that the success of the Chicago convention should make keener the feelings with which we deplore the necessity for the abandonment of even the comparatively small, but by no means unimportant, congresses that it was hoped might have taken place in Scotland last month.

We wonder whether the time will ever come when we shall regularly look forward to a mid-year gathering of men (and perhaps women!) representative of all branches of British electrical engineering and trading—an event by the date of which our overseas relations might regulate their travels to the Mother Country. That engineers are sociable beings is demonstrated by the large support that is being given to the Engineers' Club movement, and we believe that electrical and allied interests would, under proper organisation, and with the boosting influence of a second Commerford Martin, hold what would be for us very big and profitable annual congresses. Our colonial and other overseas friends might send their special delegates, and representatives could be elected to attend on behalf of all sorts and conditions of electrical associations in the British Isles. We have innumerable small bodies normally acting for limited and specialised interests. Surely these could all concentrate now and then for the consideration of matters of common interest to the profession and industry—not merely for the sake of making a big event do we advocate such a development, though there is something to be said for the big thing even if we are only on this side of the Atlantic. We believe that this would result in the industry reaping benefit internally in its own domestic relations, while there would be external advantages, such as the impression that would be made upon the minds of millions of people who know practically nothing about the extent or importance of British electrical industry, as well as upon the minds of men whose avocation calls them to the centre of the City of London, and to whom we must look for financial backing for the enormous expenditure of capital that the electrical industry legitimately anticipates within the next five or ten years. We will not make comparisons between the British Association, which exists for the advancement of all branches of science,

and one section of it, but large centres in the British Isles which are eager to show hospitality and shelter to the B.A., whose attendances sometimes run to several thousands, might find it of equal advantage to entertain in their cities a thousand or two electrical men, especially if certain electrical organisations were to concentrate simultaneously upon making an electrical gala and exhibition demonstration in the same area.

We do not think it possible to indulge too frequently in prophecy regarding the future greatness of the electrical industry, and we observe that Mr. Samuel Insull, president of the Commonwealth Edison Co., in an address on the future expansion in the use of central station power, delivered at one of the large general sessions of the Chicago convention, was full of the spirit of progress. He referred to the troubled waters through which industrial concerns had been passing, and their consequent failure to pay dividends, and placed this state of affairs in contrast with the central-station business which was "getting back to its own," and getting ready for the time when the financial clouds would roll by and more stable conditions would prevail in business generally. The fundamental cause of this Mr. Insull describes as the inherent strength of the central-station business. "We are engaged in a business that has not yet reached a point of saturation, and are not so much governed by the ordinary laws of supply and demand as some of our friends in other forms of public utility business" (such as street railroad, water, and gas supplies). "Therefore," he added, "when hard times come along the main effect on us is a reduction in the percentage of increased business." "It would take a long period of depression to put the electric light and power industry in a position where its actual business, taking the country as a whole, would show a decrease in output, as compared with the previous year." While the difficulty of the last few years in coping with the increased business owing to lack of plant and equipment may have been such that "business-getting" departments have been practically disbanded, Mr. Insull now urges that if the present depression continues, his hearers should get busy with their business-getting departments. In the later parts of his address he dwelt upon some of the vast territorial areas in the States in which there is scope for electrical men, and the ample water power "that nobody but the Creator can interfere with." But he warned his hearers of the dangers that would follow if the heads of bureaus in Washington, in their efforts to enlarge their sphere, got such a hold on the electricity supply business as to curtail its development during the next quarter of a century. He held us up as the horrible example which should be avoided at all costs, as the following quotation will show:—

"We ought to profit somewhat by the experience of the English, who have been trying for years to get out of the situation created by the Chamberlain Bill in the '80's, which resulted in the establishing of 61 different undertakings for the supply of energy in the County of London, and resulted in the territory of 7,500,000 people using less energy than the city of Chicago with 2,500,000 people, and at a cost to the user in the County of London greater—that is, the bare cost of production, without interest or anything else—greater than the average selling price of the same product in the city of Chicago. Those are the things we ought to guard against."

Mr. Martin J. Insull, president of the N.E.L.A., in the course of his opening address to the convention, referred to the immense amount of work that lay before the American electric supply industry. He said it was estimated that for the next five years the electric light and power industry would require, to provide for the demands that would be made upon it by the public, approximately $1,000,000,000 per year. This sum will be spent upon the necessary steam and hydroelectric generating equipment and transmission and distribution systems with all the appurtenances necessary to give service. "Put into figures that may be more easily appreciated, approximately $3,000,000 every day or $125,000 every hour for the next five years must be provided and used for the public benefit." If it could not be provided the public would be the sufferer.

Mr. Insull mentioned the necessity for securing the confidence of the public, to whom they must look to provide this capital. It must be recognised by them that the money was judiciously spent on property that could be economically and efficiently operated, and those concerned must plan to bring to the properties such different classes of business as would give the greatest return on the dollar invested. He added that on entering this period of vast money requirement they must give this question of their public relations the most careful consideration, as upon this very largely depended their ability successfully to take care of the anticipated requirements of the public. "Under present regulatory conditions the public, through their representatives, determine the class of service we shall give, the rates we shall charge, and the securities we shall issue. These representatives cannot help but have their judgment more or less affected by public opinion. The investor would be more easily attracted to our business, which is one affected by a public interest, if he knew that it had a generally favourable public opinion."

The unfortunate fact is that in this country, as Mr. Samuel Insull indicated, the industrial aspect of the business has for 40 years been subordinated to political considerations, from which it appears impossible to break loose. True, we have at last a body of Electricity Commissioners who can be trusted to do their utmost to develop the industry on sounder lines than have been followed in the past; but it is a Herculean task to burst the trammels that afflict the industry, and we see the political element constantly cropping up when electrical questions are under discussion. In passing, we must confess that we are seriously concerned for the physical welfare of the Commissioners, whose labours are almost superhuman, and who must undoubtedly be undergoing a strain upon their mental and corporeal faculties approaching the limit of endurance.

With regard to the future of the electrical industry, we are no less optimistic than Mr. Samuel Insull, whose remarks apply almost as aptly to British conditions as to those of his adopted country. Mr. Martin J. Insull quotes figures that almost leave one breathless, and cannot here be paralleled, but the principle which he puts forward—that the industry must command the confidence of the public in order to obtain the relatively immense capital sums that are essential to the due development of electricity supply—is wholly sound and equally applicable to British conditions. We recently explained at some length the functions of the Public Utility Commissioners to which he refers; similar functions will be exercised by our Electricity Commissioners and Joint Electricity Authorities, if all goes well, and on their policy it will depend whether the confidence of the investing public is gained for the industry, or not. Much might be done to enlighten the lay Press with regard to the true circumstances, in order to prevent the harmful "scares" which are periodically stirred up by those who worship "the god of things as they are." The British popular Press is not venal, but it is extraordinarily amenable to the persuasion of any wire-puller who comes along with a popular cry.

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**Fuel Economy.**

Once more we may recall the fact that one, if not the only, important principle at the base of the reports which led to the formulation of a national scheme for electricity supply was the necessity for economising fuel. That factor has not in the least diminished in weight—rather the contrary—though it does not appear to receive much attention nowadays. We were sharply reminded of the fact by one of the arguments put forward on behalf of linking-up *versus* the erection of super-stations for the supply of the London area—namely, that, as many of the existing stations were uneconomical, the advantage of a fall in thep rice of coal would be greater in the case of the former than in that of the latter.

That is an argument which makes for cheapness, it is true—but at the expense of economy of fuel.

We by no means advocate the hasty erection of huge generating stations at a fabulous cost, merely to economise fuel; the engineers responsible for the schemes before the Commissioners have made the rather belated discovery, since last October, that the linking-up system will meet all present needs, and it is certainly the least costly method of dealing with the situation; but the economy of coal thereby effected is so small that the hoped-for reduction in the price of coal is actually used as an argument in its favour!

Whilst working out the most rational procedure in dealing with this complex question, let us not forget all about the main plank of our platform—*fuel economy*.

---

**The Mining and Engineering Disputes.**

On Tuesday last the Prime Minister announced in the House of Commons that as a result of the negotiations between the miners, the mine-owners, and the Government, an agreement had been reached. The men's Executive will recommend the miners to accept the terms of settlement, and if they do so will ask the men to return to work on Monday next. There will thus have been a cessation of work from April 1st until July 4th. Wages are to form a first charge on the mining industry, and a standard is to be set up below which wages will not fall. The standard is 20 per cent. above the pre-war rate of earnings. For every £100 received by the workman in respect of his standard wage, the owner is to take £17, and further proceeds are divisible in the proportion of 83 to the workman and 17 to the owner. The settlement is to be effective until September 30th, 1922, and may be terminated then or thereafter by giving three months' notice. The first reduction in wages will take place in July, and will not exceed 2s. per shift, 2s. 6d. in August, and in September 3s. per shift. After that the permanent arrangement comes into full operation. The Government subsidy of £10,000,000, which had been withdrawn, will be reinstated, and the House of Commons will be asked to vote the grant.

Everybody interested in the revival of British industry will feel relieved that the struggle is ended, and that there is a prospect of eighteen months' coal peace. The engineers who are balloting this week on the revised terms offered by the employers stand under a great responsibility. It would be deplorable if just as there was a resumption of operations in the pits a period of idleness should commence in the engineering works. The reports available at the moment are not very promising, but the case for a reduction of wages as a means of lowering the cost of production is overwhelmingly strong. We cannot imagine that the engineers will desire to resort to an endurance strike which can only be wasteful to everybody—employé, employer, the engineering industry and the nation as a whole. We trust that a way will be found for a speedier settlement to be reached than proved possible in the mining industry. It was never so urgently necessary as it is now that we should all settle down to real hard word.

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**The Post Office and Trade.**

Mr. Kellaway, addressing a Primrose League gathering in Bedfordshire, said he had had to begin his work as Postmaster-General by doing a most unpopular thing in raising the postal charges. We believe that he knew the seriousness of his proposals before the public heard of them; the public by its loud and unanimous condemnation of them merely confirmed what he knew already; and when he stood up in the House of Commons to make his statement the atmosphere was uncomfortably chilly. Mr. Kellaway now says that he looks forward to the time when these increased charges will be taken off. If only industrial conditions improve and trade picks up, he hopes to remove them. We hope he will. The dropping of his advisers' proposals to tax prohibitively the circulation of printed papers and catalogues abroad was a relief to all who want to see an early revival of export trade, but we would point out that what remains of the Kellaway policy is still in restraint of trade; the increased charges are more likely to handicap British trade than to give it any chance of picking up. At the same time it seems almost certain that the aforesaid policy will not bring increased revenue or effect any saving. It may be that the postman will call at the door with one letter and one postcard, instead of two letters and two postcards. He will walk his rounds just the same, and there will be no saving in his wages. The abolition of Sunday collections and deliveries in the Provinces as well as in London, is a serious hardship, and one which places us still further back in comparison with Continental nations, who are amazed at our methods. It has been noticed in many business houses that Monday morning's mail is smaller than it used to be.

We believe that the increased charges on railway travelling are also penalising commercial travellers and the general public as well, without bringing any real help and assistance to the companies, except in the case of the tubes, and some local services, where people are obliged to travel to their business, and are, therefore, at the mercy of this method of obtaining revenue. In other cases, we believe that the reduction in travelling more than counterbalances the increased charges, and many trains are running half empty, even in these times of reduced services.

Such methods of management damage trade, and injure the travelling public, and do no one any good.

It is high time that the Government dropped the delusion that the only way to make a business pay is to charge more for the services rendered. The adoption of this as the one and only panacea for the present deplorable state of expensive inefficiency into which it has allowed our public services to fall, should be abandoned.

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**A New Phenomenon.**

In a long and interesting letter to *Nature* of June 23rd, Prof. Elihu Thomson announces the discovery in April last of a new magneto-optical effect. His son, Mr. Malcolm Thomson, was using a resistance welder by which the current was applied intermittently, when one of the operators, Mr. Davis, drew his attention to a peculiar intermittent illumination of the space near the welder as the current went on and off. Sunlight was shining across the space, and a single-turn loop from the welding transformer, forming the connection with the work, was carrying 7,000 amperes. On investigating the conditions, Mr. Thomson found that the effect was most conspicuous when viewed at right angles to the magnetic field and to the beam of sunlight. Prof. Thomson examined the luminous effect with a Nicol prism, and found that the light was polarised. Further investigations showed that the effect was dependent upon the presence of finely divided particles from iron arcs used for welding in the building, particularly associated with a yellowish-grey fume arising from the arc, and that the polarisation was complete in the case of this fume, though the magnetic field was strongly curved. An exceedingly small amount of the material makes the whole of the air in a large room capable of showing the effect, the particles being extremely fine, remaining suspended in the air for a long time, and being quickly diffused throughout the space. Microscopic examination of the fumes suggested that the minute particles were often strung together like tiny chains.

We have not space to pursue the matter further, and we do not suggest that the phenomenon has any direct bearing on industry; whether it will lead to utilitarian results remains to be seen. But it is unquestionably of great interest from the point of view of pure science, and it affords an apt illustration of intelligent observation. Mr. Davis noticed an effect which appeared to be novel and unexpected; probably many others had seen it before him, but it had made no impression on their minds. The history of science is full of instances of phenomena thus seen but not appreciated—the man who eventually realises the fact that he is face to face with something new is called a genius, simply because his mind is on the alert.

D

# ELECTRIC VACUUM CLEANERS.

## BY ONE WHO HAS USED THEM.

That there is a wide demand for an effective and inexpensive cleaning machine cannot be doubted, for science has been making such strides lately, that the housewife takes it as a matter of course that some machine to lighten the labour of cleaning her house has been devised.

It has been proved, and, indeed, does not need much demonstration, that the simplest, cleanliest, and most healthy way of removing dirt, is by introducing it to a vacuum. The dirt does not stop to argue—it goes.

But, like everything else, knowledge is essential to the use of an electric vacuum cleaner—the knowledge of how to utilise it to the best advantage.

The salesman selling the machine is familiar with its demonstration points, but he will not enlarge on such common faults as clogging of the dustbag, the motor running without oil, the nozzle rubbing right into the carpet, &c.—indeed, it is doubtful if he has ever concerned himself about its working troubles at all. The luckless purchaser is left to find these out for himself, and discover the remedy by sad experience.

In view of this fact, the dealer will find it worth while to acquaint himself with the common misuses of electric vacuum cleaners, and to forearm his prospective customer by forewarning him.

As one who has witnessed many scrapes with troublesome and rebellious vacuum cleaners, I propose to discuss in the following article the various troubles and drawbacks attendant on the use of vacuum cleaners, in the hope that it may prove of some assistance to the dealer.

One of the chief reasons of a cleaner not proving effective is that the common mistake of lowering the nozzle right down on to the carpet has been made. When a vacuum cleaner is provided with adjustable wheels this is a very serious error, for instead of gaining a better suction, the suction power is diminished. The user should always see that the wheels are adjusted to keep the nozzle the correct distance from the floor or carpet to be cleaned.

What should happen is that the carpet should be lifted a short distance off the floor and held there by the suction. In addition to getting a strong suction, there is also a current of fresh air flowing through the carpet.

When cleaning felt, or some similar floor covering, this is sometimes too heavy to rise to the nozzle, and should this be the case, the latter should be lowered, but not, if possible, actually to the level of the felt. The principle of keeping the nozzle at least one-eighth of an inch off the carpet or rug should be strictly adhered to, unless the carpet is nailed down to the floor.

The prospective owner of a vacuum cleaner should be made well aware of this fact.

Any cleaner which does not provide a suction capable of lifting the carpet this distance is not worth consideration, and the dealer is strongly advised to leave it alone.

Users are often great sinners with regard to the dustbags. It is very painful to see a good vacuum cleaner rendered almost useless, because the bag has become too full or, as sometimes happens, choked at the neck.

Where there is no exit for the air there can be no suction, and it frequently happens that through the bag not being properly emptied, the inlet becomes choked, and the suction is considerably reduced.

This is particularly true of bags which are emptied at the opposite end to the inlet, and those bags which are provided with side pockets for the dust to collect in, the latter being particularly subject to the nuisance of choking.

The bag cannot be emptied too often.

Most dealers have no doubt met the old lady who, having purchased some electrical appliance, complains some months later that it won't work properly, and makes a noise, and she is getting afraid of it. And she has to be told that it won't work properly or cease making a noise—until it is oiled again.

It is extraordinary how many people will use an electric vacuum cleaner many hours a day and never think of oiling it. Needless to say, this considerably shortens the life of the motor, and makes the machine much more noisy than it should be.

There has been much controversy of late as to whether revolving brushes inside the nozzle are effective or otherwise.

From my own observations, I should prefer not to use a machine with a motor-driven brush in preference to a simple vacuum cleaner, for several reasons.

A motor-driven brush certainly takes up any fluff or nails which may be lying about, but it is also certain that it takes up the nap of the carpet. Also, should the carpet be delicate, or be of felt, the revolving brush will injure it.

It has been claimed that the vibration of the brush will loosen the embedded dirt, so that the suction can bring the dirt out of the carpet more readily. There is certainly some truth in this, but it will not, contrary to popular belief, bring dirt right through the carpet.

I have often seen a most effective demonstration where a machine with a motor-driven brush inside the nozzle has been stood upside down, and a piece of felt put over the nozzle.

Some dirt is then put on the felt, and the cleaner switched on. The beating action of the brush vibrates the felt, and the dirt is seen to disappear through it. But it is the vibration which pulls the dirt through, not the suction, for should the same piece of felt be laid on the floor, and the dirt put under it, the same cleaner will not affect it in the slightest.

Vibration under a carpet may draw the dust down, but vibration over the carpet will not draw the dirt up. A small fixed brush inside the nozzle is often met with, but, although a useful addition, it is not very effective.

Lately vacuum cleaners have been put on the market with a small revolving brush inside the nozzle, simply driven by wheels making contact with the floor, but this is not really of any material assistance to the suction, provided the suction is all that it should be.

Simplicity is an essential in any electric household appliance. The average housewife does not appreciate complicated actions. She is afraid of them. Certainly, as regards vacuum cleaners, simplicity is one of the most important features, and the dealer would do well to concentrate on the more simple type of cleaner rather than on the more complicated one.

For constant use, especially where subjected to hard wear, the fewer parts there are to get out of order the better. The vacuum cleaner is necessarily often in the hands of those who understand nothing about it, and it is subjected to sundry shocks and blows in consequence.

Switches operated automatically by a movement of the handle and other ingenious contrivances are all very well, but in actual everyday use they have their drawbacks. The most convenient form of switch is the one on the end of the handle, which, by slightly twisting, the machine is switched on or off.

Another important feature of the simpler machine is its lighter weight, a considerable advantage when the machine has to be lifted about by a woman.

And last, but not least, the simpler machine is usually cheaper. But apart from the question of price, the simpler type of machine is undoubtedly superior to the more complicated cleaner, for many reasons.

Enthusiastic salesmen should be warned that a vacuum will not do impossibilities in cleaning.

There is a popular impression that a vacuum takes up dirt in a fashion that puts all other cleaning devices to shame, but this is somewhat erroneous.

A vacuum cleaner will clean a carpet more effectively than any known form of household appliance, but very often a little work on the furniture with a duster will be more effective than the accessories of the cleaner.

Should the place to be cleaned be an out-of-the-way corner or cornice, or shelf, however, one of the attachments is very useful, and there is no doubt that for the cleaning of mattresses and upholstery the cleaner is very effective, and much more thorough than the ordinary beating and brushing.

One of the most useful attachments in actual practice is the blowing device, the strong blast of air being much more effective in moving the dust from crevices than suction.

The result of my experience with all kinds and classes of electric vacuum cleaners is to strongly recommend the simple effective suction sweeper, with no motor-driven brush, and a suction strong enough to lift the carpet 3/16 in. off the floor.

While cheap and inferior machines should be avoided, the dealer would be well advised not to harbour the ultra expensive cleaner.

Simplicity should always be the watchword of the dealer when handling electric vacuum cleaners.

## UNEMPLOYMENT INSURANCE.

By JOS. J. H. STANSFIELD, F.C.I.S.

ABOUT ten months ago (August 9th, 1920, to be exact) the Unemployment Insurance Act, 1920, received Royal Assent, and due, or partly due to the exceptional circumstances of the times, two amendments of that Act have since become law, and a Bill has now been presented by Dr. Macnamara under the "ten minutes rule," to reduce as from July 4th, 1921, the benefits to be received and increase the contributions to be paid as provided by the principal Act, and the amendments above mentioned.

Under the Unemployment Insurance Act, 1921, the weekly benefits of 15s. for men and 12s. for women were increased to 20s. and 16s. respectively, and from July 3rd, 1921, the weekly rates payable by employed persons and employers were to be increased as follows:—

| From the employed person | Aug., 1920 | July, 1921 |
|---|---|---|
| Men | 4d. | 5d. |
| Women | 3d. | 4d. |
| Boys under 18 | 2d. | 2½d. |
| Girls under 18 | 1½d. | 2d. |
| **From the employer** | **Aug., 1920** | **July, 1921** |
| For Men | 4d. | 6d. |
| Women | 3½d. | 5d. |
| Boys under 18 | 2d. | 2½d. |
| Girls under 18 | 2d. | 2d. |

Should the Bill now introduced become law, the rates payable from next July will be materially increased before the Act passed last March comes into force, details of which will in due course be published.

Last March the Insurance Fund had a credit of over 22 million pounds, and the Government agreed to increase out-of-work pay as mentioned above, as they calculated that the accumulations which had been made during the war would last until July, 1922. The rapid growth of unemployment (which has reached 23 per cent. against the estimated percentage of 9½) has, however, upset all calculations, and the fund has fallen to 8½ millions, with entire exhaustion within early sight.

The Act of last March provided for Treasury advances not exceeding a total of 10 millions, but the new Bill proposes to increase these to double that amount, though the advances are only intended to be temporary, and are repayable with interest thereon to the Unemployment Fund.

Part of the increased cost of insurance is due to the ever increasing unemployment. Many employés have been compelled to exhaust the 16 weeks' benefit allowed by the Acts, and they cannot, as matters stand, obtain any further assistance until October or November of this year, a condition which may again arise between November, 1921, and July, 1922, and although the waiting period is to be increased from three to six days, it is proposed to ameliorate the difficulty and extend the benefits by six weeks.

The Unemployment Insurance Act, 1920, provided that the increased benefits and contributions should cease on July 1st, 1923. It will be of general interest to "wait and see" whether the Bill will vary this limited period.

## JOINT ELECTRICITY AUTHORITIES.

### London and Home Counties Inquiry.

(*Continued from page* 810.)

THE CONFERENCE SCHEME.

On the conclusion of the London County Council's case on Tuesday, June 21st, Mr. TURNER presented the proposal for the Conference of Local Authorities Owning Electricity Undertakings in the area delimited, representing all local authorities owning electricity works except Poplar, Reigate, Epsom, and Watford. The scheme of the Conference, he said, adopted the area scheduled by the Commissioners. The Joint Electricity Authority would, under the terms of Section 6 of the Act of 1919, be representative of the authorised undertakers, and to that end, the total of 29 would constitute 12 representatives of the local authorities, 12 of the companies (of whom eight would be appointed by the purchasers), three representatives of large consumers and labour, and a chairman and vice-chairman. In that way the authorised undertakers would always be in a majority, as he contended was contemplated by Section 6 of the Act of 1919, instead of in a minority, as under the L.C.C. scheme.

Counsel went on to deal with Clause 14 of the L.C.C. scheme, which lays it down that all undertakings must be transferred to the Joint Electricity Authority. He argued that this clause was *ultra vires*, inasmuch as it was virtual compulsion, whereas by Section 6 of the Electricity (Supply) Act of 1919, the consent of the authorised undertaker must be obtained.

Sir JOHN SNELL said the Commissioners would not be satisfied with any scheme which left it doubtful whether the authorised undertakers would agree or not. If all the authorised undertakers in the whole area except four were in agreement, as he gathered they were, then he could see no objection to compulsion.

Mr. TURNER said he was bound to regard the legal position, and he would show that the Conference scheme would give the same result as the L.C.C. scheme, without the same wide measure of control as was suggested in Clause 14 of the L.C.C. scheme which, he contended, was *ultra vires*.

Mr. DUNCAN WATSON, chairman of the Conference, was the first witness.

Mr. WATSON, continuing his evidence on Wednesday, June 22nd, said the Conference had been fully alive to the necessity for an improvement in the control of electricity supply in the area, but it was felt that Clause 21 of the Conference scheme which made provision for voluntary arrangements or in the alternative by an order of the Authority, subject to an appeal to the Commissioners, met the case. There were at the moment 34 local authorities willing to work the scheme voluntarily, and to use their borrowing powers. Already in the eastern and western portions of the area such voluntary linking up had been put into force.

Mr. Henderson, K.C., cross-examined on behalf of the L.C.C., and dealt first with the question of control. Mr. WATSON said the view of the conference was that the local authorities should have the right of appeal to the Commissioners, thus making the Joint Electricity Authority an effective link between the authorities and the Commissioners.

Counsel put it that the whole aim of the scheme seemed to be to cut down the powers of the Joint Authority, whereas the object of the L.C.C. scheme was to give the Joint Authority absolute control as regarded generation. Under the Local Authorities' scheme, the Joint Authority had to approve of new proposals for generating stations, and apparently could give its own consent to stations which it proposed to erect itself, without the consent of the Commissioners. The L.C.C. scheme provided for the consent of the Commissioners.

Sir John Snell said that nothing in any of the schemes could take away from the Commissioners the powers of consent to the erection of generating stations conferred on them by Parliament.

Mr. Watson, answering questions regarding purchase, said there would be no objection on the part of the local authorities to the principle of transferring their generating stations to the Joint Authority, provided the terms were satisfactory, but the objection was to the expenditure of such a large capital sum now as would be necessary.

Sir John Snell asked if the members of the Conference would object to the transference of their stations on the payment by the Joint Authority of the outstanding debt charges. Mr. Watson said a resolution had been passed by the Conference, on March 22nd, 1921, to the effect that the terms of any transfer of generating stations or transmission lines to the Joint Authority should be: (1) The taking over of the outstanding debt, or (2) payment of the capital cost less depreciation, whichever was the higher.

Another point mentioned by Mr. Henderson in cross-examination was that the Conference scheme gave the Joint Authority power to manufacture electrical machinery, and Mr. Watson thought there should be this power, if necessary, so long as the plant required was for the London scheme. The Conference scheme also provided for the payment of the chairman and vice-chairman of the Joint Authority, and also the reasonable expenses of the members, which Mr. Henderson said would increase the administrative expenses. Mr. Watson said the idea was to get the best men.

Mr. Kennedy, for the nine companies, put some questions with regard to purchase. He asked if for the companies' generating stations the same principle should be applied as had been suggested for the local authorities.

On the subject of control by the Joint Authority, Mr. Kennedy said the companies took the view that the Joint Authority should have a more practical control than was suggested by the Conference scheme. Bearing in mind the proposed appeal to the Commissioners referred to by Mr. Henderson in his cross-examination, he mentioned that no appeal to the Commissioners was suggested with regard to the technical scheme. Mr. Watson said there was no need for that, as the technical scheme was agreed. So far, however, he admitted that the local authorities had not passed any resolution pledging themselves to work it. Similarly, with regard to the capital expenditure of £1,050,000 contemplated to be necessary during the first few years, no resolution had been passed, but the money would have to be raised, although he was not prepared to say whether the money would be raised on the security of the rates or only on the undertaking. If with the security of the rates that would give an advantage of 2 per cent. to the Joint Authority.

Sir John Snell asked specifically whether Mr. Watson could give a definite assurance that the money would be raised on the security of the rates of the various districts. Unless the Commissioners had some definite evidence that the scheme would be supported favourably by the Conference authorities, they could not fairly judge between the different schemes. Mr. Watson said he could not give a definite assurance, but the estimates had been drawn up, in the engineering scheme, on the basis that the rates would be behind the raising of the capital.

Mr. Kennedy, dealing with the representation on the Joint Authority, put it that the L.C.C. or companies, if they found the money, should have a preponderating representation, but witness would not agree to that proposition.

Answering a question by the chairman, Mr. Watson said that the 34 authorities representing the Conference would agree to work the scheme, so that any difficulty with regard to Section 14 of the L.C.C. scheme being *ultra vires* would be got over in that way.

The L.C.C. proposal of autocratic control on the part of the Joint Authority was discussed between Mr. Donald, representing the East London scheme, and Mr. Watson, the result of which was complete agreement between them that, as in some parts of London linking-up had been carried out quite successfully on voluntary lines, there was no need to introduce an Authority with autocratic powers.

Mr. Donald asked specifically whether the Conference would agree to an amendment of the scheme to the effect that if a number of local authorities combined, and could provide an area which would absorb the activities of one capital station, then such an area should be formed, subject to the consent of the Commissioners. Mr. Watson replied in the negative, the reason being that it would depart from the general scheme of the proposal that there should be unification over the whole area.

Questions followed as to where economy was to come in from the work of the Joint Authority for so large an area. Mr. Watson did not agree with the figure of £40,000 or £50,000 per annum for the administrative expenses of the Joint Authority during the early years, and put the cost at nearer £20,000, because it was not proposed under the Conference scheme to set up a large administrative staff at the beginning.

Mr. Donald's case was that separating the area into a few smaller districts would result in a cheaper supply being given to industrial London. Linking-up electrically was part of his case, but he wished to be independent financially.

Mr. Watson said the aim of the Conference was the linking-up of the east of London, and at one time linking-up with the west had been suggested. Mr. Donald's retort was that this linking-up was not connected with any financial grouping; it only related to electrical linking-up. Following this up, he put it to witness that originally there was a proposal that the rates should be pledged with regard to the capital, but that it had been withdrawn in the discussions of the Conference in order to secure unanimity. Mr. Watson said it was not felt necessary to state this definitely in the scheme, but he could not imagine how the money could be raised in any other way.

Counsel for the Metropolitan Electric Supply Co. suggested that the best plan would be to deal with the County of London first, and leave the surrounding districts alone.

Mr. Baggallay, for the Middlesex County Council, raised the question of how much of the Conference scheme would fall to the ground if the Electricity Supply Bill (No. 2) did not go through, as many of the clauses of the scheme were taken from the Bill. Mr. Watson said there was no reason why any part of the scheme should go. The authorities were ready to co-ordinate the demands of the area.

Sir Herbert Nield, K.C., then cross-examined for the Hertfordshire and Surrey County Councils on the same lines as he had previously done, pointing out that as the Conference scheme, equally with the L.C.C. scheme, did not offer any immediate benefit to Hertfordshire, that county should be left out.

Mr. Kennedy, who had submitted a scheme, as the inquiry was closing for the day, said that after having heard what had taken place so far, the companies desired to make certain modifications in their scheme. Mr. Donald, for the East London district scheme, asked that a similar indulgence should be extended to the other parties if they desired.

Sir John Snell said that what was allowed to one must be allowed to all.

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When the inquiry opened on Thursday, June 23rd, Mr. Wrottesley, who appeared with Mr. Baggallay, for the Middlesex County Council, explained precisely the attitude of that body. He said there were certain objections on the part of the Middlesex County Council to all the schemes, such as those dealing with representation and finance. If certain modifications were made in the scheme of the Conference of Local Authorities, it might be that the Middlesex County Council would withdraw its objection to inclusion in the area.

Mr. Duncan Watson's cross-examination was then continued. Attention was given to the method of meeting the administrative expenses of the Joint Electricity Authority during the early years. According to the scheme, the expenses would be met by the authorised distributors taking a supply from the Joint Authority.

Sir Harry Haward said it was not quite clear what was going to happen if none of the authorised distributors took a supply from the Joint Authority during the first year or two. Who was going to meet the administrative expenses?

After considerable discussion, Mr. Watson stated that in his view all the parties concerned, whether taking a supply or not, should contribute, and to that extent he agreed with the proposals of the L.C.C.

Mr. Baker, for the North Metropolitan Power Co., said that as the scheme had been deposited, no portion of the administrative expenses would fall on his company. Now, it would seem that the company would have to bear a share of the administrative expenses in proportion to its output. Thus the larger the business of the authorised distributor the larger the sum which would have to be paid towards the administrative expenses, and the North Metropolitan Power Co., as admitted, would receive no assistance from the Joint Authority for some years.

Mr. Watson agreed, but said that the amount would be very small, as only that proportion of the administrative expenses would be levied upon the authorised distributors which was not chargeable to capital expenditure.

Mr. Watson, in reply to Mr. Baker, said the Commissioners had put forward the area, and he assumed that it had to be adhered to. On the other hand, Mr. Rider, who had advised the local authorities as well as the L.C.C., had stated that it would not hurt the scheme to cut out certain areas, having been told during the inquiry that it was not essential to feel bound to the provisional area. In that respect, Mr. Watson and Mr. Rider did not agree, because Mr. Watson had said the North Metropolitan area was essential, whilst Mr. Rider, although desiring to have the whole area, as being a suitable one for the purposes of electricity supply, had admitted that parts of the North Metropoliton area might be left out. Mr. Baker also ascertained that the basis of company representation on the Joint Electricity Authority was that all the companies were purchaseable, whereas the North Metropolitan Power Co. was not purchaseable. Mr. Watson agreed that this would require a modification of the basis of representation.

Mr. Turner, in his re-examination, pointed to an answer by Mr. Rider in which he stated that the North Metropolitan Power Co.'s area was essential to the scheme, in that it might contribute to the general supply, as well as eventually receive assistance from the general scheme. As to the proposal of the local authorities to split the area into four separate authorities, Mr. Watson said the idea was to have four divisional committees to collect information, but only one Joint Electricity Authority was intended all along. The Conference did not feel itself bound to adhere to the terms of the resolu-

tions already passed as to the purchase of the local authorities' generating stations.

Sir Harry Haward said he still could not understand the position of the local authorities as to raising capital for the purposes of the Joint Electricity Authority. Until the Electricity Supply (No. 2) Bill was passed, the local authorities had not the power to assist the Joint Authority. Even when that was possible, he did not see how the local authorities could raise money and lend it to the Joint Authority. Usually the local authorities borrowed from the L.C.C., and the best plan would be for the L.C.C. to guarantee the interest on the Joint Electricity Authority's capital.

Mr. Watson said the one thing he wished to emphasise was that the local authorities did intend that the money should be raised on the security of the rates.

Sir Harry Haward, dealing with the proposal to give the companies and the local authorities equal representation on the Joint Authority, pointed out that the capital expenditure in the case of the companies was £20,000,000 and the local authorities £12,000,000, and therefore the representation should be as 3/5 to 2/5, instead of equal.

Mr. Watson replied that the local authorities' interest was freehold, whereas the companies' interest was leasehold.

Sir Harry questioned whether the companies and the purchasing authorities should be held as one and the same. Mr. Watson thought it was right, as when the purchase took place the purchasing authorities would then have the same representation as the other local authorities. If the North Metropolitan Power Co. was taken over by the Joint Authority, he saw no reason why it should not have separate representation.

Sir Harry said that if the local authorities did not exercise their purchase rights, the extra representation would go to the companies, and that, again, rather suggested that the principle adopted in arriving at the proportion of representation was not a sound one. Another point made by Sir Harry Haward was that the City of London Corporation was given one representative, as an authority with purchase rights, and Mr. Watson said he would not deny that that was also done partly with the hope of financial assistance for the Joint Authority.

Mr. Watson agreed that if separate representation was given to the Middlesex County Council, similar claims would be made by the other counties, and that that would constitute an important alteration in this part of the scheme.

Sir Harry Haward, referring to the three representatives for railway companies, large consumers, and labour, elicited that this meant only one representative each, so that the railway companies and large consumers would only have the same representation as labour. He asked why labour should have any representation at all. Labour was already largely represented on local authorities.

Answering Mr. Page, witness said the absolute control of the Joint Authority was quite right in principle, but his experience of the past few years indicated that the same thing could be effected voluntarily, and at less expense. The absolute control aimed at by the L.C.C. scheme might probably come into effect later, when the capital stations were built, but during the first stage he believed the authorities would agree among themselves to do all that was necessary.

Mr. Lackie followed up the question, and asked if, say, eight engineers in eight stations in a particular area did not agree, the result would not be better obtained with an absolute control from the beginning by the Joint Authority. Mr. Watson said the experience was that differences did not occur in practice, but the existence of the Joint Electricity Authority to come in also, would improve the position, and was what was wanted.

Replying to the chairman, Mr. Watson said he was in favour of perpetual tenure to the companies, if the sliding scale of prices and dividends was applied. This applied to distribution, and he considered it urgent and necessary that the whole of the generating stations should in some form pass to a central authority.

Sir John Snell suggested that if the Commissioners were able to evolve a scheme out of the first three schemes, it would be desirable that some definite principle should be inserted, upon which the stations should be acquired and the distributors controlled.

Mr. Watson replied that if that could be done the Commissioners would amply have justified their appointment.

Sir John Snell suggested that the promoters of the three first proposals should confer on the matter. He did not, however, wish other promoters to think that the most impartial consideration would not be given to their schemes. That was a risk he ran in making such a suggestion. He added that the differences between the Conference and the L.C.C. were so small that they ought to be capable of easy solution.

Mr. C. H. Wordingham, who took part, with Mr. Rider, Sir Alexander Kennedy, and Mr. G. W. Partridge, in drawing up the technical scheme, was then called. On the question of control by the Joint Authority, he said he would prefer autocratic powers. The difficulty, however, was that there was no power of compulsion under the Act of 1919, and that made it extremely difficult to draft these schemes. The clauses in the Conference scheme gave a very large measure of control nevertheless. Although there were not autocratic powers of control in the Joint Authority, the initiative came from it, and its decisions were subject to the approval of the Commissioners. On the question of the reasons for advising the linking-up scheme as opposed to erecting capital stations at once, Mr. Wordingham agreed with the views already put forward by Mr. Rider, adding that as many of the existing stations were uneconomical, the advantage of a fall in price of coal would be greater than would be the case in a capital station working under more economical conditions. Starting from the point, therefore, that the cost of supply from the linking-up scheme and from capital stations built at once, would be about the same, it followed that greater advantages would be obtained from a fall in the price of coal from the linking up scheme in the early years. As to railway supply, Mr. Wordingham said that any supply to the railways should be on the basis of a definite maximum demand, a definite annual consumption, a price which involved no loss, a contract for a period of years to enable the capital expenditure to be justified, and, finally, reasonable notice of the railway companies' demand. At the same time, he said that railway companies could supply themselves more cheaply. The combined supply would benefit from the existence of the railway load, but the railway would suffer from the combination, because it would have to bear part of the expenditure on transmission and administration not connected with the railway load.

Sir John Snell said there seemed no reason why the railway companies should be charged more than the actual costs attributable to their load, properly apportioned out. In that case, he did not see that the railway companies could generate more cheaply than a capital station for a joint supply. Indeed, he thought that by combining the two loads in one station both must benefit compared with dealing with the railway load from one station and the general supply, less railway load, from another station.

Continuing his evidence, Mr. Wordingham referred to the advantage of being able to supply the outlying districts from the railway mains, as already indicated by the chairman. On the general technical details, he agreed with the scheme put forward by Mr. Rider.

Mr. Craig Henderson cross-examined to the effect that autocratic powers of control on the part of the Joint Authority were necessary.

Mr. Wordingham said it would be necessary for someone to control the use of the stations in the best interests, but that was a control dealing with the needs of the moment, which was quite different from deciding a general policy.

A discussion took place as to the desirability of erecting capital stations, with a long loan repayment period. Mr. Wordingham said he had very little hope that the Commissioners would grant a longer period than was usually allowed. In any case, in present conditions, he would prefer to put in new plant—much of which was already ordered—in the existing stations rather than to erect new buildings for them in the form of a capital station, involving new transmission mains.

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On Friday, June 24th, Mr. Donald continued his cross-examination of Mr. Wordingham. Dealing with the powers given to the Electricity Commissioners under Section 19 of the Act of 1919, Mr. Donald said that so long as the Commissioners refrained from setting up a Joint Authority for London they could do the whole of the work proposed under Part I of the scheme under consideration. That being the case, if the new capital stations were not to be erected for ten years, he suggested that the better course for the Commissioners to take would be to refrain from setting up any Joint Authority until that work was carried out. This would result in a considerable saving in the way of administrative expenses. The chairman, however, intimated that the question of the advisability of setting up a Joint Authority or not under the powers given them was one upon which he would like the help of counsel at a later stage.

In answer to Mr. Tyndal Atkinson, who cross-examined on behalf of the Hertfordshire County Council, Mr. Wordingham said that the exclusion of Hertfordshire from the area to be supplied would not affect the position of the inner districts of London very much, but Hertfordshire would benefit by coming into the scheme now. After some discussion on the subject of price, witness agreed that there would be a point in length of transmission at which the price of 1.326d. per unit, which was the price at which it would be received at the bus bars of the authorised distributors, would be increased, due to transmission losses.

Cross-examined by Mr. Szlumper, for the Surrey County Council, Mr. Wordingham said that if the supply area of any particular undertaking were cut in two by the boundary of the present scheme, by all means it should be brought in. He had no sympathy with the idea of enlarging the area to a county boundary just because it was a county boundary.

Mr. Wordingham assured Mr. Wrottesley, who cross-examined on behalf of the Middlesex County Council, that under the proposed scheme the Joint Authority would be able to supply at such a pressure as would enable it geographically to supply the whole area. In the first stage it was proposed to supply at 6,000 to 10,000 volts, but in certain cases it could transform up to 33,000 volts. It could supply at a pressure of 6,000 to 10,000 volts at any distance up to ten miles. The mains would be underground, except where the country was open, when overhead mains would be adopted. In the last stage of the scheme the Middlesex area would be supplied from the Chiswick station in normal times, but,

of course, the whole of the stations would be linked-up in order to help each other in abnormal times.

In answer to the chairman, who raised the point of zoning in connection with charges, Mr. Wordingham said he would not propose a series of circles round the various generating stations, within which the price differed from that in the outer areas. In his own view there would have to be a very large central zone in which the rates and charges on the load-factor basis would be uniform. He did not think they would be justified in charging the same rates anywhere on the fringe of the area as in the central parts of London.

Sir Harry Haward put a number of questions with regard to the future fall in prices of plant, but Mr. Wordingham could not give any estimate as to the extent to which they would fall. If, as assumed by Sir Harry, the fall in prices during the next three years amounted to 25 per cent., thus reducing the estimated expenditure of 13 millions to 9¾ millions, the scheme would be much more promising. The price of coal must not be left out of account. Assuming a reduction in the cost of plant of 25 per cent., and a fall of ½ per cent. on capital during the next three years, there would be, said Sir Harry, a reduction in capital charges on the 13 millions of £260,000 a year. Such assumptions Mr. Wordingham did not consider unreasonable.

Mr. Page, following up the railway load question, got from Mr. Wordingham the opinion that the cost of generation in a station supplying railways as well as general supply would be lower than in a station without the railway load, but he was not able to give a figure of the difference in cost per unit. If the Joint Authority could get the railways, said Mr. Wordingham, he would be only too glad. His evidence had been on the assumption that a railway company would have sufficient load to put up its own capital station.

Mr. Page: Yesterday you rather gave the impression that it would not pay a railway company to buy its energy from the Joint Authority, but now that we have examined the matter further, would you be prepared to say that in certain circumstances what you said yesterday will not hold?

Mr. Wordingham said he ought to have said he was "afraid" the Joint Authority would not get the railway load. If the assumptions he had made were not sound, then his opinion would not hold. In certain events it might be worth the while of the railway companies to buy from the Joint Authority. In any case, he looked forward to interlinking between the railway power stations.

Mr. Booth, in the course of his questions, said the railway companies had told the Board of Trade Electric Supply Committee that they would be prepared to purchase electrical energy if they could be assured that it would be cheap, and the supply reliable. So far there was no railway company in the area whose load would be sufficient to justify a capital station to deal with it. Moreover, he put it that a supply would be more reliable from a linked-up system than if reliance were placed on the railway company's own station.

Mr. Wordingham said that it could be argued that the linked-up supply would be the more reliable. He added, however, that with the one exception of the L.B. & S.C. Railway, all the London railway companies which wanted a supply had put up their own stations.

Sir John Snell suggested that that was due to the fact that there was no other available source of supply. Sir John also brought out the point, which he said had not been mentioned, that existing undertakers, such as the power companies, might be helped considerably by assistance from the Joint Authority in enabling them to deal with districts which they had not supplied hitherto. Moreover, Sir John put it, and obtained Mr. Wordingham's acquiescence, that the mere fact of the availability of supply to the existing undertakings from the Joint Authority would go a long way to breaking down the barriers which had hitherto hampered electrical development in this country.

The promoters of the Conference scheme had intended to call Mr. Arthur Collins, the financial expert. Unfortunately, Mr. Collins had been taken ill and could not attend, and it was agreed to call him later.

Mr. Rider was then recalled to explain further tables which he had prepared, putting in greater detail some of the tables already given, and elaborating certain figures given during his evidence.

Very few questions were put on these tables by way of cross-examination. Mr. Donald, however, mentioned that there was an actual case of two stations, one of which was shut down for a certain period of the day, in which there had been an actual saving of £2,700 per annum in wages. On this basis, it did not seem to him that Mr. Rider, in his estimates, had allowed sufficient in respect of this saving.

Mr. Rider said the estimates had been prepared in such a way that nobody could say that they unduly favoured the scheme.

In answer to Sir Harry Haward, he added that no provision had been made for savings in wages due to linking-up, because whilst the station was working at all there would not be much saving in this respect. The chief saving would be in respect of the coal used. There would be certain savings in wages as regarded actual generation, but for the most part the wages so saved would have to go on to distribution.

Mr. Kennedy then opened the case for the proposal by the nine London companies which had put forward a scheme as the London Electricity Joint Committee, 1920, Ltd. This scheme has been considerably modified since it was first drafted, and we deal with it in the words of Mr. Kennedy. The nine companies concerned, viz., the London Electric, the Charing Cross, City & West End, Metropolitan, Central, Westminster, Kensington & Knightsbridge, Brompton & Kensington, Chelsea, and St. James's & Pall Mall, have a capital of approximately £10,250,000, and the units generated in 1919 were roughly 196,500,000. The companies' capital, he continued, represented 6½ per cent. of the total capital and the output 65 per cent. of the units sold by all the companies in London. The City of London Co., although not associated with the scheme, was in friendly communication with the promoters, and it was hoped to secure its co-operation eventually. Taking the area delimited by the Commissioners, the nine companies concerned in the present scheme represented 31½ per cent. of the total subscribed capital and 21½ per cent. of the units sold by both the companies and local authorities. The area served by the nine companies represented a very substantial and compact nucleus around which to build a scheme, even if the nine companies stood alone, which he did not believe they would do. After mentioning that the technical part of the scheme was the same as that already described in respect of the two previous proposals, counsel explained that during the past few years, excluding the war period, the average total increase in demand in the area had been 20,500 kW per annum, but the estimates in the engineering scheme had been based on an increase of 26,000 kW per annum during the next six years, and 36,000 kW per annum during the succeeding five years. The estimates were got out when the figures for 1919 only were known, but the subsequent figures for 1920 had shown that the estimate was within 2 per cent. of the actual. The figures did not include railway load. A calculation had been made which showed that in an area represented by a circle with a radius of ten miles, with St. Paul's as the centre, the nine companies were supplying 93 per cent. of the total load of the whole area delimited by the Commissioners. The total load inside the circle was 432,866 kW, and the bulk of the load outside was in the hands of the North Metropolitan Electric Power Co., viz., 25,000 kW out of a total of 32,400 kW. Moreover, the North Metropolitan Electric Power Co. was in friendly relationship with the nine promoting companies, and there would be no difficulty in arranging for mutual supply. It was for these reasons that in the amended scheme the area to be dealt with by the Joint Authority proposed was represented by a circle with a radius of ten miles having St. Paul's as the centre. At the same time, from the administrative point of view, it might be well that the outside districts should come under the Joint Authority in order that they might have the benefit of its advice, and in the future, be connected up to the transmission system in the inner area. If the Commissioners thought it right that the Joint Authority should have control over the outside districts, the promoters of the present scheme would have no objection, although they did not think it would make for economy for one authority to have control over so large an area. Counsel went through the figures of generating plant now available and on order, already given by Mr. Rider, leading up to the expenditure of £1,050,000 during the first five years on linking-up mains, adding that £4,500,000 capital expenditure had already been sanctioned by the Commissioners for new plant in the existing stations, and the capital charges upon it must be paid in any event. That new plant represented the additions taken into account in the estimates for the first five years, and the cost of energy when that plant was installed, and the linking-up scheme was complete, would be considerably lower than the average now. Then came the next stage, and the problem was not to be dealt with by calling the linking-up scheme parochial and the capital power station scheme visionary. There were two alternatives, either to extend the existing stations to their full possible capacity, which was estimated at 832,000 kW, which would deal with a maximum demand of 650,000 kW at a capital expenditure of £9,750,000, of which £2,500,000 would represent initial expenditure during this period in preparing for the capital stations to come later; or, to build new capital stations to deal with the load after 1925 at a capital expenditure of nearly £24,000,000. The advantage in costs of energy was estimated at 0.034d. per unit by adopting this course. On this matter, he confessed to some difference of opinion between the engineers' committee. Mr. Rider was inclined to the first course, and Sir Alexander Kennedy and Mr. Partridge were inclined to the second, viz., to build capital stations to deal with the load after 1925. At the same time, all the engineers concerned felt that now was not the proper time to settle the point, and that it might well be left for the Joint Authority to determine when it came into being.

Coming to the administrative part of the scheme, Mr. Kennedy said he had grave doubts whether it was competent for the Commissioners to give any compulsory powers to the Joint Electricity Authority for any area that might be decided upon, and even if it were, he did not believe that any scheme could be satisfactorily worked by unwilling co-operators. Therefore, the essence of the scheme must be agreement on the part of the local authorities and companies. If no other undertakers would join the scheme, the Committee of the Companies now concerned had passed a resolution pledging themselves to recommend their constituent companies to find the £1,050,000 which would be necessary in the first instance,

and to start to get something done at once. At the same time it was sincerely hoped that the other undertakers would join the scheme, which had been framed so that this could be done from time to time. That applied to the local authorities; to the companies a time limit had been given.

The constitution of the Joint Authority was next dealt with. No definite number had been assigned to the number of representatives, the basis of representation being that each authorised undertaker who entered into an agreement to take a supply, or had agreed to lend not less than £100,000, or guarantee the interest on not less than £100,000, should have one representative, the voting powers being one vote for every £100,000 so dealt with. In addition, the L.C.C. would appoint five representatives, the City Corporation one, railway companies 3, and local authorities outside the County of London from whom any purchasing rights had been transferred to the Joint Authority two. In addition, the chairman and vice-chairman would be elected from outside.

Sir Harry Haward asked how many possible members there were from the authorised distributors who could enter into agreements to take a supply.

Mr. Kennedy said the total number was 44.

Sir John Snell said it would help the Commissioners if a statement could be prepared showing under one or two possible cases, what would be the ultimate constitution of the proposed Joint Authority.

Sir Harry Haward also asked for it to be explained why agreements to take a supply or to guarantee £100,000 were put on a parity as regards voting power.

The inquiry was about to close for the day when Counsel for the railway companies said he did not wish it to be understood that the railway companies had definitely refused to come into any scheme. They were out to buy in the cheapest market.

Sir John Snell said he hoped the railway companies would give the Commissioners all the assistance they could by putting forward a scheme showing what they hoped to do in separate generating stations.

Counsel for the railway companies said there were difficulties in the way of putting forward definite proposals, but all he wished to make clear now was that the railway companies would buy in the cheapest market.

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On Tuesday, June 28th, Mr. Kennedy continued his statement of the case for the proposal of the nine companies, and dealt first with a request by Sir Harry Haward on Friday for the reasons why a distributing authority entering into an agreement for supply and one guaranteeing a sum of money should be given the same representation. He confessed that there was no definite basis, but the undertakers who entered into an agreement were obviously entitled to representation. There were cases in which authorised distributors did not own generating stations, such as Bethnal Green, and such people might come in by guaranteeing a sum of money. He could not go further than to say that both classes of undertakers ought to be represented on the Joint Authority; under the Technical Committee's scheme to be dealt with later, each of the undertakers that leased their undertakings to the Joint Authority would be entitled to a representative. In order to prevent a local authority obtaining an undue proportion of votes by putting up an exceptionally large sum of money, it was proposed to limit the number of votes which any authority could have. At present, in the scheme, no number was inserted, but it was felt that five might be a fair number as a total for any particular authority.

In answer to Sir Harry Haward, Mr. Kennedy said he could find no precedent for constituting a Joint Authority on this basis, but neither could he find any precedent for the constitution of such an authority at all, viz., by agreement.

Continuing, counsel said it was proposed to pay the chairman and vice-chairman, but not the members of the Joint Authority; in that the scheme agreed with the L.C.C. scheme, but differed from the scheme of the Conference of Local Authorities. Local authorities could come in and join the Joint Authority, with the consent of the Commissioners, but a time limit was placed upon the companies coming in.

Some questions were put by the Commissioners with regard to this proposed constitution of the Joint Authority, particularly as to when it could be regarded as complete.

Sir John Snell said it seemed to him that the broad principle was that at different stages a finite number of representatives would be arrived at, *e.g.*, when all the authorised distributors had come in; and that thereafter their measure of voting power might increase or vary according to the degree of financial responsibility assumed.

Mr. Kennedy agreed that that was so. For instance, it might be that the companies with a smaller number of representatives would have a larger voting power than the local authorities.

Answering further questions, Mr. Kennedy said that the companies must enter into agreements with the Joint Authority after the making but before the confirmation of the scheme, because it was felt that it would be useless to confirm a scheme if there was no chance of there being sufficient undertakers who would transfer their generating stations and transmission lines. As an inducement to the companies, an extension of tenure as distributors was offered, which point he would deal with later.

Coming to the terms upon which the Joint Authority would acquire the generating stations and transmission lines, counsel said there would be a rent equal to 7 per cent. on the cost of the station appearing in the books of the undertaking, less such depreciation as had been allowed by the income tax authorities, with the addition of an annual sum which would wipe out the cost so arrived at in a certain number of years, so that at the end of that period the generating station and transmission lines would become the property of the Joint Authority.

Counsel confessed it was a complicated matter. In terms, this proposal applied to local authorities as well as companies. If the local authorities made other suggestions, which had the same effect, the companies would not object. Really, the proposal was a hire-purchase rather than a lease, and was suggested in order that the money should not have to be found in a lump sum. A later clause in the scheme gave an option for the undertaker to go to arbitration to determine the price to be paid.

Sir John Snell said it would be helpful if the Commissioners could be told whether the nine companies were willing to accept the principle of cost less depreciation without the option to ask for arbitration, because the former was definite, whereas the latter was very indefinite.

Mr. Kennedy promised to confer with his clients and let the Commissioners know.

Continuing, counsel pointed out the other leading features of the scheme. Thus, the Joint Authority would have no control over any authorised distributor not taking a supply. The extension of the life of the companies as distributors was to be for 60 years from a date to be fixed. Later, it was provided that the Joint Authority must supply authorised distributors at a price not higher than that at which the authorised distributors could have generated electricity themselves.

Sir John Snell asked whether it had been considered that the terms of purchase proposed would allow the Joint Authority to supply at as low a price as that previously obtaining.

Mr. Kennedy said the engineers considered they would if a proper scheme of co-ordinated control was adopted.

Continuing, counsel said that the Joint Authority was to appoint a Finance Committee, and no expenditure exceeding £1,000 was to be incurred without the recommendation of that committee. Further, a Technical Committee, consisting of five members, was to be appointed, three of whom were to be members of the Authority and two might, but need not, be elected from outside the Authority. As to capital, the companies had been advised by eminent counsel that it would only have powers to mortgage the undertaking but not to issue stock, until the No. 2 Electricity Bill was passed.

Dealing with the expenses of the Authority, it was provided that these should be met and defrayed out of (1) the proceeds of the sale of electrical energy; (2) grants from the Imperial Exchequer made on the recommendations of the Commissioners; (3) contributions by any bodies entitled to make them.

Sir John Snell drew attention to the proposed grants from the Imperial Exchequer, and asked how they were to be obtained.

Mr. Kennedy replied, amidst some laughter, that he had no doubt the Imperial Exchequer would look with a kindly eye upon any recommendations by the Commissioners.

Describing the area proposed—it was originally that delimited by the Commissioners—counsel said it was now a district within a radius of ten miles from St. Paul's Cathedral, but exclusive of any parts of the respective areas of supply of the North Metropolitan Electric Power Supply Co., and the Metropolitan Electric Supply Co., that were outside the administrative County of London.

Sir John Snell said the Commissioners would have to put many questions on the subject of the area, as, according to the map, there would arise several complications as between authorities within it which were giving bulk supplies outside the area now proposed.

In his concluding remarks, Mr. Kennedy said that both the L.C.C. and local authorities' schemes were unacceptable, because the companies were not given adequate representation on the Joint Authority. The companies did not object to a municipal scheme so long as the Authority purchased the companies' generating stations outright, and came under an agreement to give a supply, but they were not prepared to lease their generating stations to such an Authority. As to the railways, it seemed to the companies that this was largely a matter for the railways themselves. It would not pay the railway companies to erect power stations of their own, and put quite generally, it was purely an economic problem.

Mr. W. F. Fladgate, chairman of the London Electricity Joint Committee (1920), Ltd., and of the Charing Cross, West End & City Electricity Supply Co., said the Joint Committee had been formed to act as a Joint Electricity Authority under the Electricity Supply Act of 1919. The individual nine companies concerned would have to be consulted through their shareholders before any definite scheme was decided upon, but he had had the advantage of consulting with the nine companies, and knew their views. So far as the area was concerned, his own opinion was that the area delimited by the Commissioners was too large. The companies did not look upon a possible purchase by the L.C.C. with any particular fear. They could perfectly well meet all their statutory

obligations until 1931, and have a surplus, although there might be some difficulty in raising the necessary capital during the last few years. At the same time, it was greatly to the advantage of the purchasing authority that something should be done, otherwise the position from the public point of view in 1931 would be very unsatisfactory, because the companies, without some prospects beyond 1931, could not afford to lay interconnecting mains, which was the first and a most important step. The board of the Joint Committee of the companies had passed a resolution approving of the amended scheme as now submitted to the Commissioners, and recommending that the companies should guarantee up to £1,200,000 either alone or in conjunction with the other London companies. He did not believe he would have any difficulty in obtaining the consent of the Charing Cross Co.'s shareholders to providing their share of this amount. The terms of the lease proposed were that the rent was to be ascertained by taking the cost of the station in the books of the local authority or company. As regards land and buildings, there should be no depreciation, because in the case of land, this would have appreciated, whilst buildings erected some years ago could not now be erected for three or four times the cost. As to mains, it had been suggested that they should be depreciated 3 per cent. on a diminishing value, and plant at 5 per cent. on a diminishing value. This was the income tax basis. Having arrived at the total figure, it was suggested that 7 per cent. should be the rent, although, personally, he would be content with 6 or 6½ per cent., because if too high a rate was asked, it would be cheaper for the Joint Authority to raise the money at once and pay the companies out. That he would like to avoid. In addition, there must be a percentage for paying off the cost, and that should be spread over as long a period as possible; say, 60 years, to coincide with the proposed extended tenure of the companies as distributors.

In answer to the chairman, Mr. FLADGATE said he would recommend all the nine companies to take the purchase terms as set out without requiring the option of arbitration. If the scheme was sanctioned by the Commissioners, the nine companies would be advised by the Joint Committee to find the £1,050,000 required for the first stage as set out in the engineers' technical scheme, if, before the scheme was finally confirmed, it was made sure that there were a sufficient number of authorised distributors willing to join the scheme to make it worth while. As things stood at present, the companies were in a very unsatisfactory state, because they did not know whether they would be purchased in 1931 or not, and that was bound to be reflected in the condition which the purchasing authority would find when the time came to purchase.

Discussing the area, Mr. FLADGATE said he was not bound by the ten miles now suggested, and he was quite willing to modify the area. The point was that the four capital stations were within the limits now proposed, and it would not be wise to extend unduly beyond the area which could be served by these stations most economically. That area was practically contained in the ten miles circle, because outside that area the load was comparatively small.

Discussing with counsel for the L.C.C., Mr. FLADGATE said that as the scheme now stood, those companies which did not agree to come in before the scheme was confirmed would not have an opportunity of coming in afterwards. It was, however, for the Commissioners to say whether further time should be given, as in the case of the local authorities.

Mr. FLADGATE also said that the scheme provided for absolute control by the Finance Committee of finance, and by the Technical Committee of engineering, without any supervision by the Joint Authority. He regarded the other members of the Joint Authority in the same way as shareholders who had appointed a board of directors.

Continuing, Mr. FLADGATE said it was a difficult thing to decide what powers the Commissioners had under the Act of 1919 before such a scheme as this could be put into operation. For instance, he did not believe the Commissioners could give an extension of the companies' period of life as distributors.

Mr. TURNER, for the Conference scheme, and Sir HARRY HAWARD raised the question of how the public was to benefit by any reduction in the price of energy, and Mr. FLADGATE said that involved the whole matter of charges which would have to be dealt with by Parliament. He was willing to accept the principle that reductions in working costs should inure to the consumer.

Mr. DONALD said that if the proposed terms of purchase were applied, the consumer would suffer unless the Joint Authority was able to effect economies seeing that the 7 per cent. rental paid to the distributor by the Joint Authority must fall on the consumer eventually. The 7 per cent. would have to be charged to the distributor in the price of current if economies could not be made to enable the Joint Authority to supply at the same rates as the distributors were now generating at for themselves.

Mr. FLADGATE was of the emphatic opinion that the consumer would not suffer in any way. The whole object was to cheapen supply, and he believed it would do this eventually. He also agreed to take in, say, Middlesex and other parts if the power stations in these areas were transferred. Otherwise he would not agree. At the same time, he preferred a small area to begin with.

*(To be continued.)*

## LEGAL.

HURST ELECTRIC PLANT, LTD., *v.* CAVAN LIGHT AND POWER CO.

AT Dublin recently, before Mr. Justice Gordon, plaintiffs, who carry on business at Belfast, sought to recover £335 for a switchboard which they had made and completed for the defendants. The defendants denied the contract, and pleaded that the switchboard was not supplied by plaintiffs within the time agreed upon. The plaintiffs, in their reply, stated that there was no specified time, and that if there was, it had been waived by mutual consent. Judgment was reserved.

J. P. HALL & CO. *v.* THE KING.

IN the Court of Appeal, on June 23rd, the hearing of this case was concluded, the company having appealed from a decision of Mr. Justice Bailhache in favour of the Crown. According to the report of the case in the *Financial Times*, the appellants by Petition of Right claimed to recover the cost of providing a canteen for their workers during the war when they were a controlled establishment. In common with other controlled establishments, they were urged by the Ministry of Munitions to supply adequate facilities for the supply of food and refreshment for their workers. In response to that request the appellants expended £1,700 in erecting the canteen, and the Liquor Control Board recommended that £1,500 should be returned to the suppliants. However, when the E.P.D. Act came into force the authorities decided to deal with the matter under E.P.D., in which case appellants said they would only get 60 per cent. of their £1,500. Mr. Justice Bailhache held that the authorities had treated the matter properly, and discharged the petition.

At the conclusion of the arguments in the Court of Appeal, Lord Justice BANKES, in giving judgment, said that the agreement was that the cost of the canteen might be written off against current profits. Under that provision and the then existing legislation the whole cost would have been thrown upon the Government, but E.P.D. became applicable to suppliants' business before the time came for ascertaining how the agreement was to be carried out. Therefore, instead of the Government paying the whole of the cost, they would only have to pay a portion of it if the essential term of the agreement were complied with—namely, that the cost should be written off against current profits. The suppliants were not entitled to depart from that essential term of the contract, and the cost must be written off current profits and not against the sum payable to the Government by way of excess profits. The other members of the Court concurred, and the appeal was dismissed.

SWARREN, LTD.

MR. JUSTICE P. O. LAWRENCE, in the Companies Winding-up Court on Tuesday, made an order for the compulsory liquidation of Swarren, Ltd., upon the petition of the Electrical Supplies Co., of Tottenham Court Road. Mr. J. E. Harman appeared for the petitioners, who, he said, were judgment creditors, and the company did not appear.

**New X-Ray Apparatus.**—The authorities of the West London Hospital announce that they are in possession of new X-ray apparatus which makes use of rays of a wave-length not hitherto employed. The voltage is 200 000. The apparatus is the design of a Bavarian radiologist, and the equipment is the only one in England. The high claim is made, according to *The Times*, by the hospital authorities that: "Surgery as a treatment for cancer may be entirely out of date in a few years' time through the special form of X-rays now in use in the West London Hospital. A figure of cures as high as 80 per cent. of the cases thus treated is looked for by those who are by no means extravagantly hopeful." It is also stated that the rays do not injure the patient in the slightest degree. The tendency of radiologists has been to obtain tubes giving rays of higher penetration, and the tubes referred to by the West London Hospital authorities afford the "hardest" rays yet achieved. Opinion is on the whole favourable to the movement, though some authorities are of opinion that the present method of using radium with X-rays is probably as good as anything that is likely to be achieved by X-rays alone, no matter how penetrating they may be. The point in connection with cancer is that the hard rays have a selective action on cancerous tissues. They have also an action on some normal human tissues, but it is possible that when a very great degree of hardness is reached, the action may be on the malignant tissue only. In any case, Coolidge has it is said, reported favourably on the new movement. It is also stated that American makers believe they can supply tubes capable of being used with voltages of 1,000,000. It is evidently too early as yet to dogmatise. The work is in an experimental stage. We can only watch it with interest and hope.

# BUSINESS NOTES.

**The "Electrical Review" Index.**—The Index to Vol. LXXXVIII of the ELECTRICAL REVIEW, which will shortly be printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 6d. post free. Any reader or advertiser, at home or abroad, who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C. 4.

**Our Telephone Numbers.**—The telephone numbers of the ELECTRICAL REVIEW have been changed, and are now both on the Central Exchange. The numbers are :—Central 8260 and 8261. We shall be glad if our readers will kindly take note.

**Bankruptcy Proceedings.**—WILLIAM AARON DAVIS, electrical engineer, 14, Basinghall Street, Leeds, late 3, Coronation Street, Leeds. The following are creditors herein :—

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| British Pure Oil, Grease, and Carbide Co. | £105 | Manchester Lean and Discount Co. | £716 |
| Cuthbie & Co., Chas. L. | 31 | Munro, A. R. B. | 36 |
| Dawson, Henry | 76 | Bankers | 516 |
| Denison, E. A. | 13 | Newby & Sons, T. | 23 |
| Endurance Cycle Co. | 10 | Westwood & Co., Ltd. | 448 |
| Grassham, T. & W. | 21 | | |

The public examination of this debtor was held on June 21st at the County Court House, Albion Place, Leeds. Debtor stated that the receiving order was made on May 5th last, on a creditor's petition. According to the statement of affairs the ranking liabilities were returned at £2,004, against assets £244, or a deficiency of £1,760. It appeared that he went to Leeds in 1918, after being discharged from the Army. He commenced business at 3, Coronation Street, Leeds, without capital, but borrowed £60 from a friend, and £40 from a moneylender. After a few weeks he entered into partnership with two others, who brought in £150 and £250 respectively. In December, 1919, the partnership was dissolved, debtor paying out his partners' capital, and continuing the business alone. He engaged travellers and others on the condition that they invested money in the business, being paid 10 per cent. interest and £4 10s. a week salary. In this way he obtained £3,000 capital, of which £500 had subsequently been repaid. In March, 1919, he commenced at 44, Silver Royd Hill, Wortley, Leeds, as an electrical battery maker, engaging travellers and others who put money into the concern in amounts ranging from £100 to £600. This business was incorporated as a limited company in November, 1919, and at the close of 1920 debtor sold to the same company for £1,000 cash and 2,000 shares, his Coronation Street business. The shares were allotted to him, but he stated that he did not receive the £1,000 cash. The household furniture was claimed by his wife. The examination was closed.

B. T. DALE, electrical engineer, Erick Street, Newcastle-on-Tyne.—Receiving order made June 18th, on debtor's own petition. First meeting July 6th, at Official Receiver's Offices, Newcastle-on-Tyne. Public examination, July 14th, at the County Court, Newcastle-on-Tyne.

A. KERSHAW and C. H. WOOD (Kershaw & Wood), electrical engineers and merchants, 9, Bradford Road, Dewsbury.—Last day for proofs for dividend, July 11th. Trustee, Mr. C. Turner, 155, Norfolk Street, Sheffield.

H. ROTHWELL, S. J. WATSON, F. C. JINKS (Vulco Magneto Co.), 11, Long Acre, W.C.—Receiving order made June 23rd on creditors' petition. First meeting, July 7th ; public examination, September 27th ; both at Carey Street, W.C.

**Dissolution of Partnership.**—"GIBSONS," electricians, 47, Kent Street, Great Grimsby.—Mr. F. T. Habershaw and Mr. J. E. Brader have dissolved partnership. Debts will be attended to by Mr. F. T. Habershaw, who will continue the business.

**Company Liquidations.**—DALTON, DOWNES & CO., LTD., wholesale electrical factors, Manchester.—Pursuant to Section 188 of the Companies (Consolidation) Act, a meeting of the creditors of the above was held recently at the offices of the liquidator, Mr. Perkin S. Booth, 2, Bixteth Street, Liverpool. A statement of affairs was presented which showed unsecured liabilities £4,547, of which £4,324 was due to trade creditors, £167 to cash creditors, and £56 to the bank. There were contingent liabilities £236, not expected to rank. The assets comprised stock-in-trade, at cost, £728, estimated to realise £400 ; trade fixtures, fittings, utensils, &c., at cost, £250, valued at £50 ; and book debts £1,772, expected to produce £1,419. The total assets were, therefore, £1,869, from which £50 had to be deducted for preferential claims, leaving net assets of £1,510, or a deficiency as regarded the unsecured creditors of £2,737.

The liquidator stated that the company was registered on December 10th, 1920, to take over an existing business. The nominal capital was £5,000 made up as follows :—200 preference shares of £10 each and 3,000 ordinary shares of £1 each. The total issued share capital consisted of 10 preference shares and 1,347 ordinary shares, which were issued for cash, with the exception of 750 to the vendor of the business. No directors' fees had been paid. The rent of the premises was £52 per annum on a lease of three years from January 24th, 1920. The books had not been made up to date, but the liquidator stated that the turnover in December, 1920, amounted to £886 ; in January, 1921, £1,558 ; February, 1921, £484 ; and March, 1921, £447. There was an estimated loss on the trading of £780, while the balance of the deficiency was accounted for by depreciation of stock, £328 ; depreciation of fixtures, £200 ; depreciation of book debts, £354 ; amount paid for goodwill, £750 ; premium paid for premises, £300 ; and preliminary expenses, £135. After discussing the position the creditors resolved to confirm the appointment of Mr. Booth as liquidator, while a committee of inspection was also appointed. The following are creditors :—

| | | | |
|---|---|---|---|
| A. & A. Electrical Co. | £116 | Hills, H. G., | £80 |
| Ashworth & Smith, Ltd. | 17 | Jones & Pordes | 13 |
| Braulik, G., | 41 | Lutley, J., | 10 |
| Bearsall & Co., Ltd. | 52 | Lowth & Smith, Ltd. | 121 |
| B.E. Co. | 13 | Macdonald, C. J., & Son | 148 |
| B.T.T. Elec. Lamp & Acces. Co. | 31 | *Manchester City News* | 14 |
| Barnes, H., | 14 | Guardian, Ltd. | 33 |
| O'Brien, R., & Co. | 105 | Niell, John, Ltd. | 14 |
| Buckland, C., | 10 | Newman, E. C., & Co., Ltd. | 28 |
| *Cabinet Maker* | 67 | Napier-Kimber, Ltd. | 58 |
| Cheadle & Waltho, Ltd. | 65 | Odhams Press, Ltd. | 17 |
| Claremont Johnson | 22 | Photector Co. | 46 |
| Casellian Marble Co. | 254 | Richardson & Co. | 15 |
| Dainty Modern Machines | 49 | Rhodes, Ltd. | 29 |
| Driver, Drennan & Cooper | 37 | Rainsford & Lynes | 40 |
| Edison Swan Elec. Co., Ltd. | 25 | Read, F. O., & Co., Ltd. | 47 |
| Electric Fires, Ltd. | 79 | Shepherd & Hope | 18 |
| Elec. Eng. & Equit. Co. | 45 | Southward Lighting Co. | 106 |
| Electric Heating Co. | 106 | Spencer Works | 102 |
| Electrical Supplies Co. | 111 | Stella Lamp Co. | 96 |
| Electric Block Co., Ltd. | 12 | Stella Conduit Co., Ltd. | 32 |
| Electric Brasswares, Ltd. | 20 | Sloan Electrical Co., Ltd. | 56 |
| *Hardware Trade Journal* | 84 | Shrimpton & Sons | 12 |
| Holt, W., & Co. | 18 | Svenska Elec. Co. | 1,328 |

MESSRS. PETER HARVEY, LTD., general engineers and brassfounders, Victoria Bridge Engineering Works, Stockton-on-Tees.—Meeting of creditors called for July 7th. Liquidator, Mr. T. R. G. Rowland, Victoria Buildings, Stockton-on-Tees.

ANGLO-FOREIGN TRAMWAY SYNDICATE, LTD.—A meeting is called for July 27th, at Sardinia House, Sardinia Street, W.C., to hear an account of the winding-up from the liquidator, Mr. A. F. Dickin.

ARMORDUCT BRITISH CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. A. Pepper, 14, Temple Street, Birmingham. A meeting of creditors is called for July 14th.

DEVON HYDRO-ELECTRIC AND DEVELOPMENT CO., LTD.—Winding up voluntarily. Liquidator, Mr. T. W. W. Melhuish, the secretary of the company.

**Trade Announcements.**—The general offices and stores of MESSRS. A. VEREY & CO., LTD., have now been removed to 27, Buckingham Gate, Victoria Street, S.W. 1. They retain only a small part of the premises at 67, Borough Road. New telephone number, "Victoria 3180."

MR. S. G. JONES has removed to 72-74, Victoria Street, London, S.W. 1. Telephone number, "Victoria 3650" ; telegraphic address, "Jonofied Sowest, London."

THE EDISON SWAN ELECTRIC CO., LTD., announces that, having just completed considerable alterations and extensions at its City warehouse, 123-5, Queen Victoria Street, E.C. 4, large stocks of lamps, fittings, accessories, &c., will be held at that address as from to-day, and all orders, inquiries, &c., in the London area will be dealt with from there instead of from the works.

**Catalogues and Lists.**—MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C. 2.—Publication W.L. 1 (40 pp.). A very comprehensive catalogue of cut-outs of many types. The list, which gives prices, and is profusely illustrated, includes 1, 2, 3, and 4-pole boxes with open, bridge and cartridge type fuses. Mounted sets consisting of cut-outs and sealing chambers are illustrated, as well as watertight and other specially-arranged boxes.

MESSRS. RICHARD GARRETT & SONS, LTD., Leiston, Suffolk.—An illustrated card giving particulars of the Garrett power plant, which combines boiler, superheater, engine, and condenser in one unit.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—An illustrated price list of conduits, conduit fittings, lighting fixtures and appliances, including distribution boards, bowl fittings, and electric irons.

MESSRS. W. H. DORMAN & CO., LTD., Stafford.—A well illustrated brochure (68 pp.) dealing with "wave-power" tools and machinery, including rock drills, rivetters, pile-driving equipment, &c. A description of this method of transmitting power is included in the publication.

THE PYNE MANUFACTURING CO., Latimer Road, Teddington.—An illustrated and priced catalogue of switchgear, fusegear, switchboards for kinemas and country houses, arc lamps for kinema projection, &c.

THE BRITISH CELLULOSE AND CHEMICAL MANUFACTURING CO., LTD., 8, Waterloo Place, S.W. 1.—A pamphlet dealing with the properties and uses of "Celastoid" safety celluloid.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Supply List No. 150/12, giving numerous illustrations, prices, and descriptions of all kinds of domestic electric heating and cooking apparatus such as fires, kettles, irons, urns, hotplates, &c. Also Publication No. 4,150/3, dealing with "Cosmos" electric radiators.

MESSRS. GEORGE ELLISON, Perry Barr, Birmingham.—A publication giving eight pages of illustrations of control gear, including circuit-breakers, starters, crane-control equipment, and unit-type switchgear.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.—Installation Leaflet No. P 2479, describing and illustrating the electrical equipment of an hotel.

THE EDISON SWAN ELECTRIC CO., LTD., Ponders End, Middlesex.—List No. LL 299, giving prices of various sizes of "Fullolite" and "Daylight" gasfilled lamps.

MULLARD RADIO VALVE CO., LTD., Claybrooke Road, Hammersmith, W. 6.—A well-produced catalogue giving details and illustrations of a number of receiving, transmitting, and rectifying valves. Fully priced.

MESSRS. GABRIEL & CO., 4 and 5, A B Row, Birmingham.—An illustrated leaflet dealing with an improved electric lantern and spares and accessories, including a charging board.

HIGHTENSITE, LTD., Normandy Works, Custom House, E.—"Improvements in Insulating Materials," a list describing the advantages and characteristics of "Hightensite," and giving illustrations of many parts and articles made of this material.

MESSRS. G. HOGG & SONS, 66, Waterloo Road, Smethwick.—Leaflet giving reduced prices of porcelain electrical goods.

THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, S.W. 8.—Leaflet H 42/6 illustrating and describing air-break and oil-immersed auto-transformer starters (drum type) for two and three-phase squirrel-cage motors. Fully priced.

BRITISH AND ALLIED ELECTRICAL AGENCY, LTD., Ely House, 13, Charterhouse Street, E.C. 1.—An illustrated and priced leaflet dealing with the "Lowa" dimming switch.

THE CRESSALL MANUFACTURING CO., 40 and 41, Staniforth Street, Birmingham.—List No. C.R. 1921, giving illustrated descriptions of controller resistances for cranes, lifts, hoists, &c.

MESSRS. W. ROBINSON & CO., 53, Summer Row, Birmingham.—A catalogue illustrating monorail hoists, electric lifting blocks, spur-gear winches, friction hoists, &c.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., 20, Brazennose Street, Manchester.—Special Publication No. 7,840/2.—A well-illustrated and fully descriptive brochure dealing with individual drive and control of machine tools. The illustrations show the application of electric motors to various types of machines, enclosed ventilating motors and control units.

**Catalogues Wanted.** — MESSRS. A. ORMROD & CO., wholesale merchants and factors, of Wigan, wish to receive trade price-lists and discount particulars from manufacturers of domestic electric labour-saving devices.

**Miners' Lamps.**—The Mines Department of the Board of Trade has just issued the Safety Lamps Order of April 20th, 1921 (No. 672), naming and describing in Part I five new electric safety lamps which have been approved for use in all mines to which the Coal Mines Act, 1911, applies. The first is the "Pearson Ni+Fe" (Alkaline Miners' Lamps, Ltd.) cylindrical accumulator lamp, which gives not less than 1-1.5 c.p. for nine hours, its weight being 4.5 lb. The "Adams" (Adams Bros. (Longton), Ltd.) is also a cylindrical lamp, but it possesses two lamp bulbs, fixed bulb to bulb vertically and connected in parallel, each having a current consumption of 0.8 amp. The lamp's total weight is 6.5 lb. The "G. 1" type of lamp (Patterson & Co.) has a 12 amp.-hour capacity, and weighs 5.75 lb., its special feature being the locking arrangement. In the "Federation" (Federation Lamp Co.) a semi-solid or dry electrolyte is used; it has a 6 amp.-hour capacity, and weighs 5 lb. 14 oz. Finally, the "Oldham" cap lamp (Oldham & Son, Ltd.) is provided with an attachment for securing the lamp to the miner's cap, and a belt for carrying the accumulator case; a protected flexible conductor connects the latter to the lamp bulb, which takes 0.7 amp., and the total weight of the outfit is 5 lb. 9 oz. Part II of the Order deals with amendments to the schedules to previous orders, and an appendix contains a list of all flame and electric safety lamps, both for general and special use, which have been approved by the department.

**Private Meeting.**—FREDERICK VIGERS & CHARLES HERBERT VIGERS, timber merchants (trading as Vigers Bros.), Balfour House, Finsbury Pavement, E.C.—In response to a circular letter issued by Messrs. Tribe, Clarke, Painter, Darton & Co., chartered accountants, a meeting of the creditors of the above was held on June 21st at the Institute of Chartered Accountants, London, E.C. According to the statement of affairs presented the unsecured liabilities amounted to £112,574. The assets were estimated to realise £50,121, or a deficiency of £62,453. The assets were as follows:—Cash in hand, £45; sundry debtors, £12,718; bills receivable, £852; E.P.D. recoverable, £16,638; plant at Hills Wharf, £4,900; Hills Wharf and buildings, £5,393; office furniture, £100; motor lorry, £162; and stocks, £9,309. The amount due to the sundry creditors was stated to be £71,339, but stock was held of the estimated value of £11,693, leaving an unsecured balance of £59,646. The bills payable were £98,664, but security was held, consisting of stock, £1,380; stocks accepted, but not delivered, £39,847, and contra accounts, £6,632. The securities totalled £47,859; the balance of £50,805 was included as an unsecured liability in the statement. There were also cash creditors for £9,908, but they held stock and other assets valued at £7,784, and were unsecured for £2,123. The bank were fully secured creditors for £6,954, their security consisting of a charge on a debt due by Messrs. Thornborough & Co., Ltd. With regard to the assets, the debtors on open accounts were £23,441, but a a reserve had been allowed of £4,090, and there were contra accounts of £6,632. That left net assets of £12,718. The partners had a claim for the repayment of E.P.D. of £20,216, but that amount was subject to £3,577 for arrears of income-tax. The balance of the purchase price of the plant at Hills Wharf was £11,855, but it was charged to secure the bank, who were creditors for £6,954, or a balance of £4,900. The land and buildings at Hills Wharf were valued in the books at £10,060, but there was a mortgage of £4,666, leaving a free balance of £5,393. One portion of the stocks was valued at £28,967, but a large amount was held by creditors, and there was a free balance of £9,309. There were further stocks which had not yet been delivered, to the value of £39,847. Those stocks were held as security by the parties from whom they had been purchased. The partners also held shares of the face value of £5,000 in Associated Importers, Ltd., but no value had been placed upon them at present. The sundry creditors, claims of £71,339 were made up as follows:—Trade creditors, £18,685; cash creditors, £12,274, and compensation creditors' £40,379. The latter were five in number, and were firms with whom contracts had been entered into for goods at future dates. It was possible that the figure mentioned would have to be amended. Mr. A. G. Westacott inquired what was the position when the last accounts were prepared on March 31st last, and the accountants stated that the figures were only prepared this month, and they showed a deficiency of £73,700. In those accounts, however, the amount recoverable for E.P.D. was not included, although the shares referred to were taken in at £5,000. In March, 1920, there was a surplus of over £47,000, and within the year that was converted into a deficiency of £73,700. The total amount paid in E.P.D. was £24,679, of which £4,463 had been recovered, leaving a balance of £20,216, which had been certified as repayable. Mr. Biddle, of Messrs. Biddle & Co., solicitors, who appeared for the debtors, stated that his clients desired to continue the business, but it was difficult for them to make an offer, as they could not tell what the compensation claims would finally be. Under the most favourable circumstances, however, they would make an offer of 7s. 6d. in the £, payable as to 2s. 6d. in the £ when the amount recoverable from the Government for E.P.D. had been received. The balance would be paid by two equal instalments of 2s. 6d. in the £, each on November 1st and March 1st next. No guarantee could be offered. The position disclosed was discussed at some length, and eventually it was decided that the meeting should be adjourned for 14 days. It was understood that in the meantime a copy of the statement of affairs submitted would be circulated to the creditors, and that a committee of the principal creditors would supervise the trading.

**Suction Gas Plant for China.**—Attention is again drawn to the demand for suction gas plant in China. Its relative cheapness appeals strongly to the Chinese. Whilst the course of exchange is just now retarding the installation of new machinery on a large scale, the demand for new plant by local electric lighting companies is becoming increasingly urgent, says the *Shanghai Times*. In these circumstances the employment of suction gas is recommended. In the centres most concerned coal is obtained locally, anthracite usually being available, and its price is not subject to the vagaries of exchange. The installations of suction gas plant at present in operation have created a very favourable impression. Several concerns in China supplying light and power are taking steps to obtain additional capital. As they must soon come into the market for machinery for extensions and renewals, it is believed that an important potential demand is developing for prime movers operating on suction gas.—*Reuter's Trade Service* (Shanghai).

**Richardsons, Westgarth & Co., Ltd.**—Presiding at the annual meeting of the company, Mr. D. B. Morison said that notwithstanding the exceptional difficulties of the year, due largely to the aftermath of the moulders' strike, the actual profits earned were considerably greater than in the previous year. Owing, however, to the E.P.D. being raised to 60 per cent., and to the addition of the Corporation profits tax, the retainable profit of £155,635, shown in the accounts, was £80,000 less than it would have been had the duty remained at 40 per cent. as in 1919 Last year he foretold a difficult future for the marine engineering industry. Events had proved that their conservative policy was eminently sound, and the result had been to place the company in a strong position, both financially and in its ability to produce much more cheaply relatively than in the past. The number of ships engined by the company during the year was 38, the aggregate marine h.p. of 96,300 being the highest in the Kingdom. The machinery comprised geared turbines and the latest type of "Richardsons" reciprocating engines, which embodied improvements that were very favourably affecting the coal consumption and the upkeep costs. In the land department, numerous turbines were supplied for the generation of electric power, whilst the number and size of "Contraflo" high-vacuum condensing plants and marine auxiliaries exceeded all previous records. The steel works department was normally busy, noteworthy features being the building of rolling mill engines of 20,000-h.p. for the Cargo Fleet Iron Co., and of many "Nesdrum" water-tube boilers, which continued to give great satisfaction in use.

**Broken Hill Plant Extensions.**—According to reports in the *Industrial Australian*, in consequence of the rapid progress being made in its subsidiary industries, the Broken Hill Proprietary Co. has to make provision for increased steel production, and the following additions to the plant will be made at an early date:—A further blast furnace; a by-product plant, to be used in conjunction with the present and the new coke ovens; a Duplex steel plant; a continuous mill for the production of billets and sheet bars; a duplication of the present rod mill; and a sulphuric acid plant for the supply of acid in connection with the production of sulphate of ammonia, and also for galvanising in connection with wire-drawing, wire netting, galvanised sheets, &c. In addition, further locomotives and railway trucks, wharfage accommodation, steam shovels and railway sidings to cope with the enlarged output will be required. The estimated expenditure is £3,500,000. —*Reuter's Trade Service* (Melbourne).

**The Rubber Crisis in Brazil.**—A dispatch in the *Financial Times* states that the Brazilian Government has been forced to assist the people of the State of Amazon, who have been badly hit by the crisis in rubber.

**Lead.**—In their report, dated June 25th, MESSRS. JAMES FORSTER & Co. state that the Metal Exchange statistics for the 12 months ending May 31st last are :—Total supplies (including stock held by the Government and on wharves on May 31st, 1920, 202,336 tons; deducting exports during the 12 months and stock remaining on May 31st, 1921, 54,008 tons; apparent consumption, 148,328 tons; monthly average, 12,360 tons. To this must be added an enormous quantity of old chemical lead from dismantled war plant disposed of to consumers by the Government, and which kept many important consumers in different parts of the country entirely out of the market for six or eight months last year. The average per month of the first five months this year left for home absorption is 10,342 tons. The monthly average for April and May of imports over exports is exactly 7,000 tons. With consumption on the level of last year (which we may fairly look for after the coal strike), it is obvious that much more lead will be needed than is coming in at present.

**Book Notices.**—*Manual of Electrical Undertakings and Directory of Officials*, 1920-21. Vol. XXIV. E. Garcke. London: Electrical Press, Ltd. Price 30s. net.—This volume hardly needs commendation nowadays. It has long justified its existence and proved its usefulness to all who require at hand, financial, technical and other statistical and general data, respecting the electrical industry and its varied undertakings. Many changes following upon the period of reorganisation and reconstruction with regard to the industry and electricity supply are recorded. No fewer than 2,760 undertakings are reviewed. The financial analysis shows a total capital of £541,862,988 subscribed in 1,374 undertakings in all branches of the industry, an increase of approximately 47 million pounds over last year's figure. The average return on capital invested has advanced from 4·76 per cent. to 5·61 per cent. over-all. The yield per cent. in the various branches of the industry is shown in the following table, which is extracted from the statistical section of the volume:—

| Class. | No. of undertakings. | Capital. | Average yield per cent. |
|---|---|---|---|
| Telegraph ... ... | 22 | £35,467,353 | 8·49 |
| Telephone ... ... | 8 | 4,418,002 | 6·76 |
| Supply ... ... | 185 | 60,622,295 | 5·58 |
| Traction ... ... | 124 | 166,082,679 | 3·47 |
| Manufacturing ... | 127 | 53,106,141 | 9·98 |
| Miscellaneous ... | 32 | 7,716,860 | 7·91 |
| | 498 | £327,413,330 | 5·61 |

The "progress of the year" section provides a record of new and propos d legislation affecting the industry, together with particulars of applications for private bills, light railway and tramway orders and special orders for electricity supply. The main portions of the "Manual," as usual, comprise information relating to electricity supply, traction, telegraph, telephone, manufacturing, financial, and miscellaneous electrical undertakings in the United Kingdom and British Dominions overseas. The largest section is devoted to a financial, statistical and commercial record of electricity supply and traction undertakings in the United Kingdom; these public services are provided by nearly 700 companies and 400 local authorities. Another and smaller section deals with telegraph and telephone undertakings in the Empire, giving names of the chief officials, the capital authorised and issued, full accounts, comparative tables, dividends paid, &c. An account of electrical manufacturing and allied companies and associations is contained in a further sec'ion, while another presents particulars of electric traction, lighting and power undertakings in Canada, West Indies, Africa, Australia, India, Mauritius, and other British Possessions overseas. The Directory section combines the names and addresses, verified to date, of about 20,000 company and municipal officials engaged in the industry, including members of the I.E.E., members of tramway and lighting committees, electrical contractors, and electrical engineers in general. The supplements include about 35 maps showing the principal electric tramway systems, the electrified railways, power undertakings in the United Kingdom and the Colonies and Dominions overseas, the areas of electric supply undertakings, and routes of electric railways in and adjoining greater London. A special feature of the present volume is the series of 13 maps showing the areas of the Electricity Districts provisionally determined by the Electricity Commissioners.

"The *Journal* of the Institution of Electrical Engineers." Vol. LIX, No. 300. April, 1921. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—The following papers are embodied in this issue :—"Some Thermal Characteristics of Electric Ovens and Hot Plates," by E. Griffiths, D.Sc., and F. H. Schofield, B.A., B.Sc.; "The Long-Distance Telephone System of the United Kingdom," by Sir W. Noble; "The Effect of Electron Emission on the Temperature of the Filament and Anode of a Thermionic Valve," by G. Stead, M.A.; "Some Thermionic Tube Circuits for Relaying and Measuring," by W. H. Eccles, D.Sc., F.R.S., and Miss W. A. Leyshon, B.Sc.; and "The Radiation Resistance of Various Types of Antenna Contruction," by A. Press.

"Electrical Machinery." By F. Annett. Pp. xiv + 432; 491 figs. London: McGraw-Hill Publishing Co., Ltd. Price 18s. net.

"Motor-Coach A.B.C." No. 1. June, 1921 (100 pp.). London: E. J. Larby, Ltd. (for the British Road-Traffic Association). Price 6d.—This forms a complete guide to motor-coach and omnibus services in all parts of the country, with details of fares and times. In addition to these, particulars of river excursions and aeroplane services are also given, as well as an alphabetical list of motor-coach proprietors.

The *Bulletin* of the Hydro-Electric Power Commission of Ontario." Vol. VIII, No. 2. March-April, 1921.—An address by Sir Adam Beck on the share of London (Ont.) in hydro-electric developments is given prominence. A report, in tabular form, showing the operation of all municipal hydro-electric stations in the province occupies several pages, and in the Technical Section methods of measuring supplies are described.

**Training of Chinese Students by Other Countries.**—The following are extracts from notes communicated by H.M. Commercial Counsellor at Shanghai to the Department of Overseas Trade :—

*United States of America.*—"The Chinese Chamber of Commerce, says the Asiatic News Agency, has been notified by some American firms in the United States that for the purpose of further promoting Sino-American Commercial relations, leading American engineering and other houses are willing to admit Chinese students to learn modern business methods after completion of their studies in American schools and colleges. The American firm promise to pay reasonable salaries to these Chinese." —*Millard's Review.*

*Belgium.*—According to a Chinese paper, the Belgian Government is planning to establish a university at Brussels for Chinese students, and has approached the Chinese Minister at Brussels to obtain the views of his Government regarding the project.

*Sino-French Engineering School at Shanghai.*—"The foreign commissioner has been notified by the Ministry of Education to the effect that at the suggestion of the French Government, the Peking Government will reorganise the former German commercial and engineering college in the French Concession of Shanghai for the purpose of training commercial students for the development of Sino-French commerce and industry. The initial and maintenance expenses of the said college will be equally borne by the Chinese and the French Governments. The French director is a prominent French resident in Shanghai who has been canvassing subscriptions in France, while the Chinese Government will provide a sum of $150,000. The college will be called the Sino-French Engineering and Commercial College, and its chief aim is to train Chinese engineers on French lines with the hope that in the coming industrial development of China, the French Republic may catch the lion's share of it. The civil governor of Kiangsu has been instructed by the Peking Government to make preparations so that the proposed college can be established as soon as the French promoter returns to Shanghai." —*Asiatic News Agency*, Shanghai.

**Applications for British Trade Marks.**—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries :—

Slipper. No. 412,163. Class 13. Sparking plugs. George H. Ward and Henry F. Kerney, trading in co-partnership, 114. Duncombe Road, Upper Holloway, London, N. February 4th, 1921.

Tangent Sound Signals (lettering and design). No. 413,023. Class 18. Electric and pneumatic bells, alarms, and engineering contrivances. Gent & Co., Ltd., Faraday Works, St. Saviour's Road East, Leicester. May 5th, 1921.

0 0 (lettering and design). No. 413,026. Class 18. Electric and pneumatic bells, alarms, and engineering contrivances. Gent and Co., Ltd., Faraday Works, St. Saviour's Road East, Leicester, May 3rd, 1921.

Fonoto. No. 412,308. Class 8. Telephone call-recorders. Jarvis Perkin & Co., 2, Drapers' Gardens, Throgmorton Street, London. E.C. February 9th, 1921.

Pinnacle. No. 413,907. Class 8. Electrical instruments and apparatus. No. 413,908. Class 13. Electrical fittings of metal. The Wholesale Electrical Co., Ltd., 54-56, Oxford Street, London, W. 1. April 1st, 1921.

Kantark. No. 404,810. Class 13. Electrical switches (ordinary), fuses, and cut-outs. Midland Electrical Manufacturing Co., Ltd., Stafford Works, Barford Street, Birmingham. June 3rd, 1920.

Lilliput. No. 413,603. Class 6. Electric dynamos, motors, fans, and blowers. Société des Moteurs et Appareils Electriques Lilliput, 41bis., Rue de Chateaudun, Paris. March 19th, 1921.

Wing Design. No. 405,158. Class 13. Sparking plugs. The Brewster Goldsmith Corporation, 33, Gold Street, New York, U.S.A. June 14th, 1920.

Delagazo. No. 410,464. Class 13. Electric lamps. Osram Gesellschaft, 11-14, Ehrenbergstrasse, Berlin, 017. December 7th, 1920.

**German Machinery in Japan.**—German importers of machinery are reported to be very actively canvassing hydro-electric companies for orders to supply electrical machinery.—*Reuter's Trade Service* (Tokio).

**Fire.**—THE CABLE ACCESSORIES CO., LTD., of Tividale, Tipton, inform us that certain Press reports having given a very much exaggerated version of the fire at their works a few weeks ago, they wish it to be known that their main factory was in no way harmed. The fire was confined to outbuildings and a yard; production and prompt delivery of goods are not interfered with.

**Australian Wages.**—Fitters' wages in Australia, except in the case of Queensland, have been fixed at £6 per week of 44 hours. Labourers in the engineering trade are to receive 14s. per day. A Victorian Wages Board determination with regard to boilermakers fixes the rates of pay at from £4 6s. up to £15, the latter being payable for certain classes of night work.—*Reuter's Trade Service.*

**Forthcoming Exhibitions.**—The following exhibitions are being organised :—

LONDON.—September 7th to 28th, Shipping, Engineering and Machinery Exhibition ; September and October, Textile Industries Exhibition ; October 14th to 22nd, Commercial Motor Exhibition ; November 4th to 12th. Passenger Motor Exhibition ; November 17th to 25th, Public Works, Roads and Transport Exhibition ; 1923, British Empire Exhibition.

CARDIFF.—1922, Welsh National Exhibition.

GLASGOW.—November 1st to 19th, Shipbuilding, Engineering, and Electrical Exhibition.

LEEDS.—July 21st, Yorkshire Agricultural Show.

CANADA (*Toronto*).—August 27th to September 10th. Canadian National Exhibition.

AUSTRIA (*Vienna*).—September 11th to 17th, International Fair.

CZECHO-SLOVAKIA (*Pressburg*).—August 6th to 15th. Czecho-Slovak Industrial Fair ; (*Reichenberg*), August 13th to 21st, International Fair.

HOLLAND (*Utrecht*).—September 6th to 16th, International Industrial Fair.

ITALY (*Naples*).—September, Samples Fair.

LATVIA (*Riga*).—August 1st to 28th, International Agricultural and Industrial Exhibition.

NORWAY (*Christiania*).—September 4th to 11th, Norwegian Industries Fair.

POLAND (*Lemberg*).—September, International Fair.

SPAIN (*Barcelona*). — September 1st to 10th, International Samples Fair.

TRIESTE.—September 11th to 25th, International Samples Fair.

ARGENTINA (*Buenos Ayres*).—1922, International Exhibition.

BRAZIL (*Rio de Janeiro*). — 1922, International Centenary Exhibition.

JAVA (*Bandoeng*).—September 9th to October 19th, Netherlands East Indies Fair.

MEXICO.—September, Commercial and Industrial Fair.

JAPAN (*Tokio*).—March 10th to July 31st, 1922, International Exhibition.

**Annual Outings.**—The employés of Mr. John Walsh, electrical engineer, of Blackburn, had their annual picnic on Friday last, when they went for a motor run to Windermere.

The staff of the General Electric Co., Ltd., held their third annual sports at the London County Ground, Herne Hill, on Saturday, June 26th, in beautiful weather. A large gathering of members of the staff of Magnet House, and of the other establishments and associated companies of the G.E.C., with their friends, witnessed the proceedings. The directors were represented by Mr. Hugo Hirst and family, Mr. and Mrs. Max Railing and family, and Mr. S. D. White. A long programme was carried through with a promptness which reflected much credit on the Welfare Superintendent, Mr. H. B. Duce, who was responsible for the organisation of the meeting. Among the more notable athletic achievements in the competitions may be mentioned the High Jump—5 ft. 7 in.—which was won by Mr. Rutherford, of the Express Lift Co., Ltd., and the 100 Yards' Championship, which was carried off by Mr. Bird, of Witton Works (10⅘ seconds). Witton Works were also successful in winning the Quarter-Mile Championship and the Relay Race. The Express Lift Co. were successful in the Tug-of-War, easily beating teams from head office and Fraser & Chalmers' Engineering Works. A similar event for ladies was won by the staff of the Entering Room, Magnet House. In a competition for Fire Brigades, the team from Fraser & Chalmers' Engineering Works was successful. At the conclusion of the sports the prizes were distributed by Mrs. Hugo Hirst, who was introduced by Mr. Hirst. An excellent military band was in attendance the whole afternoon, and provided music for dancing on the green until late in the evening.

**The Derby Royal Show.**—Among the many exhibits at the Royal Show, Derby, held from June 28th to July 2nd, are a number of agricultural appliances made by member-firms of AGRICULTURAL AND GENERAL ENGINEERS, LTD. In addition to many machines suitable for electric-motor drive, and electric motors and parts, the "Bull" electric lighting and power plant was shown. This is a very robust set designed for farms of various sizes. The engine is suitable for operating upon gas or petrol. MESSRS. RICHARD GARRETT & SONS, LTD., displayed a 2½-ton electric vehicle.

**Development in the Federated Malay States.**—The Federated Malay States Government is losing no opportunity of securing expert advice on the development of the country. The services of Mr. C. C. Reade, of the Town Planning Department of South Australia, have been requisitioned for a year to give general guidance on town planning. Prof. Gilbert J. Fowler, D.Sc., of the Indian Institute of Science, Bangalore, is at present occupied with the question of sewage disposal in the four largest towns in the Federated Malay States, namely, Kuala Lumpur, Ipoh, Seremban, and Klang. Mr. F. Bolton has also recently visited the country to give advice on the provision of electric power and light in the larger towns. Apart from town development, the question of irrigation has been receiving attention, Mr. C. E. Dupuis having recently spent six months in the country reporting on existent and proposed systems of drainage and irrigation.

**A Disclaimer.**—MESSRS. C. A. VANDERVELL & CO. LTD., who have extended the field of their industrial activities, inform us that there is no truth in certain rumours that they intend to associate themselves with the manufacture of a motor-car. Such a policy would be against their own interests as manufacturers of electrical equipments for motor-cars.

**A Norwegian Buying-in Association.**—The members of the Norwegian Electricity Supply Works Association (Norske Elektricitets Verkers Landsforening) met in annual conference at Christiania recently, when the question, among others, of establishing a central buying-in department for the purchase of all the plant and materials required by the works was discussed. It was decided to authorise the council further to consider the problem.

**Norwegian Electro-Chemical Industry.**—The directors of Det Norske Aktieselskat vor Elektrokemisk Industri, reporting on the year ended March 31st, 1921, state that considerable losses have been incurred through subsidiary companies, and the necessity for writing down shares and undertakings. It is proposed to meet these losses by appropriating the reserve fund of 522,740 kr., and by writing down the share capital from 28,000,000 kr. to 5,760,000 kr., leaving 2,278,000 kr. to be placed to the equalisation fund.

**For Sale.**—Morley Corporation Electricity Committee has for sale one boiler feed-pump and injector, two horizontal cross-compound Corliss valve engines with alternators, one vertical Belliss & Morcom high-speed engine, direct-coupled to alternator and exciter, piping, shafting, &c.

Birmingham Corporation Electricity Department has for disposal a steam-driven electrical generating plant.

Walsall Corporation Electricity Department invites offers for two natural-draught cooling towers, each with an approximate capacity of 100,000 gallons per hour. For particulars see our advertisement columns to-day.

**American Electrical Activity in Italy.**—A financial contemporary quotes an Exchange telegram from Milan, stating that a persistent report is current there that the Galileo Ferraris Electric Co. has passed under the control of the American General Electric Co.

**Unemployment.**—The returns of the Ministry of Labour for the week ended June 17th, show that the number of persons registered as unemployed was 2,178,294, a slight decrease from the previous week's total. The number of men increased, the reduction being in the number of women, boys, and girls unemployed.

**Cast-Iron Research Association.**—We have received from the British Cast-Iron Research Association a copy of a booklet setting forth the constitution, objects, and activities of the Association. Complete lists of members of Council, and the personnel of Committees are given. Details of subscriptions are included, and much information as to the Association's methods and capabilities is embodied in the 24 pages of the publication.

**Electric Furnaces in the Argentine.**—There are three important steel foundries in the Argentine—Pedro Vasena e Hijos, Cia. Industrial de Electricidad, and Juan Pinoges. The first and last operate on the Siemens-Martin principle, while the other uses two three-phase electric-arc furnaces of 1½-tons capacity each. The Vasena installation consists of one oven holding 20 tons at a charge and a second holding 35 tons, preparations being in progress for a third one of 100 tons. The Pinoges plant has five 20-ton ovens. The electrodes for all these plants have to be imported.

## LIGHTING AND POWER NOTES.

**Accrington.**—PRICE INCREASE.—The Electricity Committee has revised its scale of charges from July 1st following the loss of £12,000 on the undertaking last year. It is estimated the increased charges will produce an additional revenue of £12,000 per annum. The scale includes :—Lighting, flat rate 8d. per unit ; heating and domestic purposes other than lighting through separate meter, 3d. ; with a minimum charge of 5s. per quarter during the summer, and 10s. per quarter during winter. Rateable value basis (alternative tariff for domestic lighting, heating, and power), a fixed charge of 15 per cent. per annum on the rateable value of the house occupied, plus a charge of 2½d. per unit for all units consumed. Consumers electing to take a minimum of 15,000 units per month for a year will be charged on the following scale :—From 15,000 to 40,000 per month, 1·2d. ; 40,001 to 80,000, 1·15d. ; 80,001 to 160,000, 1·1d. ; over 160,000, 1·05d., subject to fluctuation with the cost of fuel.

**Australia.**—MELBOURNE.—During the first quarter of the present year the Sydney City Council lost £39,260 in operating its electricity department. Generating costs increased by £14,000, as compared with the same period in 1920.—*Reuter's Trade Service* (Melbourne).

SYDNEY.—It was reported in May that a serious position had arisen with regard to the finances of the electricity undertaking. Owing to the department's overdraft on the Commonwealth Bank, amounting to about £670,000, the bank intimated that further cheques on capital account could not be honoured. The city electrical engineer stated that he would require in the ensuing nine weeks no less than £246,800 to meet necessary capital expenditure, wages, and commitments. It was resolved to ask the bank to honour cheques for capital expenditure, as the overdraft would be reduced by the rates and by the proceeds of a local loan of £250,000.

ELECTRICAL DEVELOPMENTS.—A *Reuter's Trade Service* communication, dated Melbourne, May 19th, states that throughout the length and breadth of Australia and New Zealand the expansion of electricity is nowhere more marked than in the smaller type of township. A scheme of some magnitude has been under-

taken in connection with the supply of power to Wellington, N.Z. The power from the River Mangahao will be derived by damming two small rivers, about one mile apart, and connecting them by a tunnel 7 ft. in diameter, cut through a hill. Approximately 24,000 h.p. will be generated, 12,000 of which will supply Wellington City. Outside Wellington itself the town of Lower Hutt is discussing a plan to provide a special hydro-electric supply by utilising the Mangaroa River.

The city of Christchurch, N.Z., has been authorised to borrow £98,000 for the distribution of electricity, and the Commonwealth Bank of Australia has agreed to advance £10,000 to the Stephens Shire Council, in Queensland, for the purpose of installing an electric light service in the shire.

The residents of the Grafton district in northern New South Wales are urging the authorities responsible to push on with the Nymboida hydro-electric proposal. The acceptance of tenders received in January last for a portion of the plant was held up owing to the financial stringency.

The committee which was appointed some time ago by the Brisbane Metropolitan Water and Sewerage Board to consider the most efficient and economical scheme for supplying electrical energy in bulk for sewerage purposes, has reported in favour of the acceptance of the recommendation of the Government electrical engineer, that transmission mains be erected to transmit 700 kW, the mains be erected in such a manner that they will be suitable, without alteration, to carry a pressure of 22,000 V, instead of the proposed 5,000.

The capital of the Electric Energy Supply Co., Ltd., Warwick (Q.), is to be increased from £12,000 to £20,000, to provide for additions to the power plant.

**Bingley.**—Year's Working.—At a meeting of the District Council it was stated by the chairman of the Electricity Committee that the loss on the past year's working was £2,500, of which £1,000 was due to the policy of meeting the cost of new services out of revenue account instead of borrowing and adding to the capital account. The Council approved an advance in the price of electricity by 1d. per unit for heating, and to small power users, and by ½d. to large power users and for lighting, the new charges running from 4d. to 4½d. and 7d. per unit.

**Birkenhead.**—Electricity Failure.—On June 27th, owing to the inferior quality of coal, there was a failure of the electricity supply, due to the impossibility of maintaining a sufficient head of steam to drive the turbines. For an hour and a half the municipal electric tramway service was at a standstill.

**Budleigh Salterton.**—Order Revoked.—The Minister of Transport has revoked the Budleigh Salterton Electric Lighting Order, 1911, as confirmed by the Electric Lighting Orders Confirmation (No. 1) Act, 1911, as to the whole of the area of supply, as from June 20th, 1921.

**Burnley.**—New Plant Delayed.—Industrial disputes have made it unlikely that the additional plant at Burnley will be completed in time for the winter load. The Committee has, therefore, decided hot to sanction further extensions of mains for the present.

Price Increase.—The Electricity Committee has decided to revise the scale of charges as follows:—For power purposes, for the first 39 hours used per quarter of maximum demand, from 2·57d. to 2·90d. per unit, and for all units above from 1·75d. to 2·08d.; for heating and domestic purposes, from 2·2d. to 2·53d. per unit; lighting, from 5½d. to 6d. per unit; for traction, from 1·9d. to 2 1d. per unit. The new scale will come into operation as from the next reading of the meters.

**Canada.**—Nova Scotia.—A plant is under construction at St. Margaret's Bay, about 15 miles from Halifax, which is expected to furnish sufficient light and power for the city, according to the American Consul-General. This is under the direction of the Nova Scotia Commission, and will mark the partial completion of its first important development. The question is yet to be decided whether the Halifax municipality or the tramway company will receive and distribute the power. Other private interests are constructing plant which will utilise the large river power of Nova Scotia.

Ontario's Financial Results.—A recent issue of the *Bulletin* of the Hydro-Electric Power Commission, gives financial details of working for the year ended December 31st last. The figures refer only to municipalities. In the Niagara system, which includes the greater part of the province, out of 125 undertakings only 12 showed a deficit, the net surplus amounting to $651,719 and a net accumulated surplus of $2,697,968. The other parts of the province, embraced by the Thunder Bay, Severn, St. Lawrence, Wasdell's, Eugenia, Ottawa, Muskoka, Rideau, and Trent Systems, include 59 undertakings. Of these only 21 showed surpluses. In spite of this, however, there was a net surplus of $51,815, making the total for the province $703,534.

**Coventry.**—Temporary Price Increase.—The electricity department is making a temporary increase in charges owing to the heavy additional expenditure incurred during the present coal shortage. The flat rate for lighting is to be 8d. per unit, and maximum demand rates are also increased. The lamp rate is increased by 1d. per house per week. The rate for bulk supplies is increased by 0·5d. per unit, low-pressure power is 2½d. per unit, while for domestic purposes, other than lighting, the price is 3d. per unit. It is notified that the temporary increases will be removed immediately the department has recouped the additional expenditure incurred during the crisis.

**Dominican Republic.**—Plant Shut Down.—According to an American Consular report, the towns of Santiago and Puerto Plata have not been able to reach an agreement for the purchase of the local electric plant, and at present it is uncertain when the plant will resume operations.

**Dundee.**—Price Increase.—Owing to a loss of £8,068 upon the past year's working, an increase of 20 per cent. in the charges for electricity has been put into force; the new rates are retrospective to May.

**Folkestone.**—Application for Order.—The Electricity Supply Co., Ltd., has applied for a special order to enable it to supply electricity in the Urban District of Cheriton, and in the parishes of Saltwood, Newington, and Hawkinge, in the area of the Elham Rural District Council.

**Guildford.**—Municipalisation of Undertaking.—It was stated at the annual meeting of the Guildford Electricity Supply Co. that an agreement had been entered into for the sale of the undertaking to the Corporation, but the date of handing over had not been settled.

**Haslingden.**—Loan.—The Town Council is applying to the Electricity Commissioners for sanction to borrow £10,000, the amount being made up as follows:—Mains, £5,000; services, £2,000; sub-station, £3,000.

**Hove.**—Price Increase.—The Town Council has raised the price of electricity for power purposes from 2½d. to 3d. per unit. This increase is necessitated by the financial position of the undertaking.

**Keighley.**—Curtailment of Supply.—Owing to the continued fuel shortage, the Corporation electricity department has now had to curtail supplies, and consequently two of the largest engineering shops in the town, hitherto working full time, have had to go on short time, and one or two smaller firms are similarly affected. The position is unfortunate, as all the engineering firms have sufficient work to keep their employés working full time.

**Kingussie.**—Proposed Water-power Scheme.—Having secured the permission of Mr. Fletcher to utilise the water power of Loch Guynack for generating electricity, the Town Council is convening a special meeting to discuss the scheme.

**London.**—St. Pancras.—A profit of £34,896 was made by the electricity undertaking during the year ended March 31st last. Of this balance £20,000 is being devoted to rate relief.

**Lyme Regis.**—Application for Order.—The Town Council proposes to apply for an Order to authorise it to supply electricity within the borough and the parish of Uplyme, and to acquire the undertaking of the Lyme Regis Electric Light and Power Co., Ltd., for this purpose.

**Medhurst and District.**—Order Revoked.—The Minister of Transport has revoked the Medhurst and District Electric Lighting Orders Confirmation (No. 4) Act, 1914, as to the whole of the area of supply, as from June 20th, 1921.

**Philippines.**—Hydro-electric Power.—What promises to be the most extensive private venture of the kind in the Philippines is now well under way in the form of a hydro-electric project designed to furnish lighting and electric power to the Provinces of Bataan and Pampamga, comprising a population of approximately 48,000. The Abo-Abo and Tiawir rivers, believed to be able to yield a capacity of some 200 h.p. each, will be utilised for the project. Field explorations of the district from which the company will develop electric power has revealed the existence of large deposits of magnetic iron ore. The iron is known to stand a high degree of temperature, and is very suitable for internal-combustion engines. Its electrical treatment has proved quite successful, and the company expects to be able to exploit it to a maximum degree.—*Commerce Reports.*

**Rhyl.**—Loan.—The Urban District Council is applying to the Electricity Commissioners for sanction to borrow £2,400 in connection with the electricity undertaking, £1,900 being for additional feeders, and £500 for strengthening the cable at the Marine Lake.

**Southend-on-Sea.**—Loan.—The Town Council has applied for sanction to a loan for the cost of over-hauling, adjusting, and setting up a Diesel engine plant, the provision of spare parts and accessories, &c., in excess of a sum already sanctioned.

**Stirling.**—Extensions.—The Town Council is applying for sanction to borrow £4,000 for the purchase of two generating sets, and £3,700 for building extensions. It has been decided to purchase immediately a second-hand 300-kW generator from Hereford at a cost of £2,000.

**Wellingborough.**—Bulk Supply.—The Urban District Council has decided to support the application of the Northampton Electric Light and Power Co. to the Electricity Commissioners for an order for the supply of electricity in bulk to Wellingborough.

**Wimbledon.**—Electricity for Houses.—In spite of the ruling of the Ministry of Health that only the cost of installing gas in the new houses would be considered for subsidy, the Borough Council has decided that electricity shall also be provided, any additional cost being defrayed by the Council.

## TRAMWAY AND RAILWAY NOTES.

**Australia.**—TOOWOOMBA.—At a recent meeting of the City Council, Messrs. F. A. McCarty & Co., consulting engineers, Sydney, submitted a revised estimate for a power house and a sub-station for the proposed tramway scheme, in accordance with up-to-date prices. The estimated cost of the complete generating station is £58,700, and of the sub-station £14,000, a total of £72,700. It was decided to ask the Government to provide an expert to go into the whole matter.—*Tenders.*

MELBOURNE.—The City Council's engineer, who has recently returned from a tour of America and Europe, has expressed his opinion, in a report presented to the Council, that two electric vehicles should be purchased for the collection of street refuse. The engineer estimates the cost of the chassis at £1 300. While he thinks that, generally speaking, motor or electric haulage will not prove cheaper in Melbourne, owing to the comparative reasonableness of horse feed prices, he is of opinion that eventually the rising cost of wages and feed must turn the scale in favour of the electric vehicle.—*Reuter's Trade Service* (Melbourne).

**Croydon.**—YEAR'S WORKING.—The annual report of the tramways manager for the year ended March 31st last, shows that the total income of the department was £178,772, as compared with £163,037 in 1919-20. Working expenses, &c., amounted to £183,387, as against £159,306, making a gross deficit of £4,615, as compared with a gross profit of £3,731 in the previous year. The payment of loan interest and other capital charges, resulted in a net deficit of £19,611, which is greater than last year's debtor balance of £17,253. The unsatisfactory result is attributed to the increased cost of labour, materials, and electricity; the increased fares have only been in operation since July 29th, 1920. The number of miles run (2,632,605) is smaller than the pre-war figure (2,801,302), but the number of passengers carried has increased by 39 per cent.

**Glasgow.**—YEAR'S WORKING.—The annual report of the Tramways Committee for the year ended March 31st last, shows total receipts of £2,392,854, a large increase on the previous year's figure—£1,721,578. Working expenses (in which are included allowances to dependents of employés serving with the Forces), amounted to £1 937.665, as against £1,558,161, leaving a gross surplus of £455.189 (£163.417). This, with interest on investments, made an available total of £470,430. Capital charges absorbed £364,644, leaving a net profit of £105,796, which compared very favourably with a deficit of £108,531 on the working of the previous year.

**Halifax.**—FARE REDUCTION.—The Tramways Committee, after hearing a deputation from the Stainland District Council, has decided, in respect of the newly-established tramway service to Stainland, to reduce the fare from 7d. to 6d.

**Leeds.**—TRAMWAY SERVICES ENDANGERED.—A great fire at the motor works of Messrs. W. Appleyard & Co., and of other concerns in Park Row, in the centre of Leeds, last week, doing damage amounting to between £70 000 and £80,000, has left the walls in such a dangerous condition, that the tramway service along Park Row is being run only on the outside set of rails for half-a-mile, a factor which has dislocated the service materially.

**London.**—L.C.C. TRAMWAYS.—The recently-published accounts of the L.C.C. tramways for the year ended March 31st last disclose another heavy loss. The total receipts amounted to £4,904,427, as compared with £4,295,846 in the previous year. Working expenses (including special charges) totalled £4,623,654, as against £3,680,899 in 1919-20, leaving a gross surplus of £280,773 (£614,947). Of this surplus £215,639 was absorbed by renewals, leaving a balance of £65,134 to meet capital charges. Deducting these, and crediting other items amounting to £69,481, left a net deficit of £590,580. The number of car-miles run rose from 53,156 060 to 57,488,232, and the number of passengers from 685,124,156 to 689,452,036. The estimates for the current financial year provide for a deficit of £7,417.

**Japan.**—NEW ELECTRIC LINES.—According to "Commerce Reports," a company has been formed for the construction and operation of a new electric line from Tokio to Yokohama, running approximately 1¼ miles inland from the present railroad. The Musashi Electric Tramway Co., as the newly-organised firm is called, will also furnish electricity to the villages *en route*. Plans are being made for the construction of a railroad 61 miles long between Nagoya and Yamada for the accommodation of visitors to the Great Shrines of Ise. Power is to be supplied by the Ibugawa Electric Power Co. Another line, 30 miles long, around the Chita Peninsula, is planned by a company to be capitalised at from 4,000,000 to 5,0 0 000 yen. There is also a project for the construction of an electric railway between Nagoya and Gifu, as the traffic between these two places is very heavy. It is proposed to construct a double-track line paralleling the present steam railway, at an estimated cost of 7,000,000 yen. A line between Gifu and Ogaki is also planned.

**Southend.**—ABOLITION OF PENNY FARES.—Owing to a loss of £22,000 brought about by curtailments rendered necessary by the coal dispute, the Town Council has decided to abolish penny fares except on one small section of the system.

## TELEGRAPH AND TELEPHONE NOTES.

**France.**—INTERNATIONAL WIRELESS CONFERENCE.—M. Paul Laffont, Under Secretary of State for Posts, Telegraphs, and Telephones, presided over the inaugural sitting of the International Technical Committee on Wireless Telegraphy, on June 21st, at Paris. The Committee comprises representatives of the Governments of Great Britain, France, Italy, Japan, and the U.S.A., who have been called together by the French Government in order to carry out the decisions arrived at by the Communications Conference which met at Washington at the end of last year. The delegates' labours will, in all probability, occupy the next two months.—*Reuter's Trade Service* (Paris).

**Germany.**—WIRELESS TELEPHONY.—The Nauen Telefunken station claims to have established wireless telephonic communication over distances of 2,700 miles. The experiment was carried out with the Argentine Government steamer *Bahia Blanca*, which was on the return voyage to South America, and on board which messages were distinctly heard. Beyond the distance named the vessel entered an area of the Atlantic where atmospheric disturbances interfered with the experiments. Before long it is hoped to establish wireless telephonic communication between Berlin and New York.—*Daily Telegraph.*

**Italy.**—STRIKE ENDING.—While the widespread postal and telegraph operators' strike has partially collapsed, and the majority of the employés have returned to work, great delays and innumerable losses in handling correspondence continue, and it will be some time before normality can be restored. The telegraphs are fast being restored to their ordinary service, and foreign messages are now being accepted, subject to possible delay and interruption.—*Reuter's Trade Service* (Rome).

**India.**—WIRELESS TELEGRAPHY.—According to the report of the Post and Telegraph Department of India for the year ending March 31st, 1920, it was decided during the year to form a separate wireless branch of the Telegraph Department to deal with all matters connected with civil wireless telegraphy in India. Communication was carried on between Bombay and Aden, Bombay and Ceylon, the bay stations and Penang and Karachi and the Persian Gulf. New apparatus was imported which considerably improved the efficiency of the several stations, particularly as regards receptivity during unfavourable conditions, and certain modern transmitting apparatus was also tested for use in India. It was found necessary to form a combined civil and military school at Karachi as a temporary measure to meet a serious shortage of operators for both civil and military requirements.

**Indo-China.**—WIRELESS TELEGRAPHY.—Wireless telegraphy is to be used as a means of communication between Saigon and Hanoi. The submarine cable which connects Cochin-China and Tonkin is subject to frequent breakage, the cost of repairing which entails greater expense than the credits allowed, and for lack of credits it has been impossible to repair a breakage which occurred in October, 1919. However, in order to assure continuity, permanence, and the regular service of telegraphic communication, the Governor-General of Indo-China considers the employment of the coast cable still necessary, and he proposes to assure all the expenditures entailed for the latter out of the Budget of the Colony. This decision would place Indo-China in possession of a submarine cable which connects its two most important points—Saigon and Haiphong.—*Commerce Reports.*

**The Telephone Service.**—NEW TRUNK CABLE.—The new telephone trunk cable between Liverpool and Chester, which has just been completed, contains 108 wires, each weighing 70 lb. per mile, and provides 54 new circuits, having a speaking efficiency six times as great as a standard cable with wires weighing 20 lb. per mile.

**Philippines.**—WIRELESS TELEGRAPHY.—According to the *Bulletin* of the Philippine Government Commercial Agency in New York, recent improvements in the naval wireless telegraph station at Cavite now enable the transmission of messages from the Philippines to San Francisco without relay. A large increase in electrical power, and the construction of telegraph lines between Cavite and Los Banos, are responsible for this direct Pacific wireless service, covering some 7,000 miles. Formerly dispatches from the islands to points in the United States were copied at Honolulu and relayed to the mainland. This meant unnecessary delay in transmission. The improvements will treble the capacity of the naval wireless service to and from the Philippines.

**An Automatic Telephone Receiver.**—It is reported that the Vogel Telegraph Wire Co., of Berlin, has sold through a Dutch company a patent in England for an automatic receiving apparatus for telephone conversations, termed the "telegraphon." The proceeds of the transaction are estimated at £1,000 000 (?), although ultimately depending on the use made of the invention.

The Poulsen "telegraphone," which receives and records telephone messages on a steel wire by electromagnetism, was fully described in the ELECTRICAL REVIEW of October 12th, 1900, and May 10th, 1901. Whether the receiver mentioned above is identical with the Poulsen instrument or not, we do not know; but the name is the same.

**Danzig.**—TELEGRAPH RATES.—It is announced that the rate for telegrams to the Danzig area is now 3d. per word.

## CONTRACTS OPEN AND CLOSED.

*(The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.)*

### OPEN.

**Aldershot.**—July 2nd. Urban District Council. Electric light wiring, Park housing scheme. F. Garside, electrical engineer.

July 5th. Urban District Council. Electricity Department. E.h.p. switchgear; l.p., d.c. switchboard, rotary converters and starting gear. (June 24th.)

**Australia.** — Melbourne. — August 10th. Victorian Railways. 250 core-type impedance bonds for power signalling, with a capacity of 1,000 amperes per rail; also 50 miles of solid insulated copper wire, No. 14 Brown & Sharpe gauge, and 50 miles of solid insulated copper wire, 16 standard gauge.

July 27th. Victorian Railways. Incandescent lamps for electric car lighting: 24,000 metal filament, 46 W, 116 V; 4,000 carbon filament, 32 W, 140 V. 5-h.p. electric motor, controller and resistances, or, alternatively, 5-h.p. electric motor and equipment.*

August 17th. 3,000 sets of renewals for caustic soda primary cells.

August 30th. Board of Works. Four electrical centrifugal pumps, each with a capacity of twelve million gallons daily.

September 7th. Victorian Railways. Sixteen sets of air-brake equipment, 450 to 600 V, d.c., for single-deck tramcars.—*Reuter's Trade Service* (Melbourne).

August 24th. Victorian Railways. Motor-generator set, accessories and switchgear (for automatic telephone exchange, Contract No. 34,132).*

August 31st. Victorian Railways. Accumulator cells and accessories, Contract No. 34,171; electric light equipment (axle generator system, Contract No. 34,172).*

October 19th. Victorian Railways. Fresh tenders are invited for the supply of an electrical furnace for the Newport workshops. —*Reuter's Trade Service* (Melbourne).

Shire of Hampden (Victoria).—August 17th. Boiler-house plant, steam-driven electricity generators, transformers, meters, switchgear, cables, poles. Specifications from Mr. H. C. Ingleton, Shire Hall, Camperdown, Victoria.—*Tenders.*

Brisbane.—July 18th. Queensland Water Supply Department. 54,000 ȝd. h.d. copper cables, various diameters, for overhead transmission wires; 2,980 ft. lead-covered, armoured copper cables, various gauges, with accessories.*

**Belgium.**—August 9th. Provincial Government authorities at Mons. Either a gas engine or electric motor, together with a pump, to raise from 150 to 200 cubic metres of water per hour from the Strepy waterworks to the Houdeng reservoirs.

**Bulgaria.**—July 11th. Department of Posts, Telegraphs and Telephones. Supply and delivery of various tools, instruments and materials. The specification and conditions of tender (in French) may be inspected on application to the Inquiry Room, Department of Overseas Trade, 35, Old Queen Street, S.W.1.

**Distington.** — July 6th. Whitehaven Urban District Council. Electricity generating plant, overhead cables, lamp fittings, cables and poles, &c., for street lighting. Mr. E. B. Crossdell, Clerk, Union Hall, Whitehaven.

**Edinburgh.**—July 11th. Electricity Supply Department. H.p. steam pipes and valves. Specification 33. (June 17th.)

July 11th. Electricity Supply Department. Storage battery (Specification No. 35). (See this issue.)

**Jugo-Slavia.**—July 18th. Minister of Posts and Telegraphs. Telephone material.*

**London.**—L.C.C. July 11th. Supplying and laying h.p. electric cables, &c. (June 24th.)

**Manchester.**—July 12th. Tramways Committee. Steel tramway poles and silicium bronze trolley wire. Mr. J. M. McElroy, General Manager.

**Mexborough.** — July 23rd. Urban District Council. Electricity Department. E.h.p. switchgear; l.p., d.c. switchboard. (See this issue.)

**New Zealand.** — Wellington. — August 9th. Public Works Department. Suspension-type porcelain insulators for the Waikato power scheme.*

**Southampton.** — July 9th. Electricity Department. Twelve months' supply of meters. (See this issue.)

**Rhyl.**—July 9th. Urban District Council. Electricity Department. 1,000 yd. 3 × 3 × 15 l.p. cable, 1-5-way feeder pillar switchboard panel and gear. (June 24th.)

**South Africa.**—Barberton. — July 29th. Municipal Council. Plant in connection with the proposed scheme for the supply of electricity:—Two steam boilers, two 75-kW steam-driven alternators, switchboard, and instruments, steel chimney piping, feed pumps, cables, &c., steel poles, conductors, &c., transformers, house service meters, &c. Specifications, £2 2s., from Prof. W. Buchanan, 75, Louis Botha Avenue, Johannesburg.

Transvaal.—Rand Water Board. September 9th. Erection of a complete installation of mechanical or other filters capable of filtering 5½ million gallons of water per 24 hours at the Vereeniging main pumping Station (Contract No. 232). Copies of the contract documents may be obtained from the Chief Engineer, Rand Water Board, Johannesburg, upon a deposit of three guineas.*

**Uruguay.**—Monte Video.—August 18th. State Electricity Works. Steel petroleum tank, Worthington duplex steam pump for oil, 250 metres steel tubing.*

September 3rd. The Commercial Secretary to His Majesty's Legation at Monte Video reports by cable to the Department of Overseas Trade, that the local authorities are advertising for tenders for the supply of 59,250 metallic-filament lamps of assorted sizes, from 10 to 300 c.p., 225 volts, which are required by the State Power House.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

### CLOSED.

**Dundalk.**—Urban District Council. Electricity Department. Many offers were received for the supply of a 15-h.p. second-hand motor, and one has been accepted.

**Glasgow.**—Tramways Committee. Accepted:—

Switchgear for turbo-alternator for Pinkston.—British Thomson-Houston Co., Ltd.

**Government Contracts.** — The following Government contracts have been placed during May, 1921:—

Admiralty (Contract and Purchase Department).

Cables, &c.—Johnson & Phillips, Ltd.
Inert cells.—Fullers' United Electric Works, Ltd.
Electric fan spares.—General Electric Co., Ltd.
Watt-hour meters.—Metropolitan-Vickers Electrical Co., Ltd.
Motor and accessories.—Fuller Electrical Manufacturing Co.

War Office.

Electric cells.—Siemens Bros. & Co.
Electric lamps.—British Thomson-Houston Co., Ltd.; Crysalco, Ltd.; Edison Swan Electric Co., Ltd.; English Electric & Siemens Supplies, Ltd.; General Electric Co., Ltd., Maxim Lamp Works, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.

Air Ministry.

Magneto spares.—North & Sons, Ltd.; British Thomson-Houston Co., Ltd.
Electric cable laying.—Pirelli General Cable Works, Ltd.
Electric wiring.—T. Clarke & Co., Ltd.
Lifts.—Medway Safety Lift Co., Ltd.
Motors.—Electric Construction Co., Ltd.

Post Office.

Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone & Electric Co., Ltd.; Western Electric Co., Ltd.
Testing apparatus.—H. W. Sullivan.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Hackbridge Cable Co., Ltd.; Pirelli General Cable Works, Ltd.
Telephone cords.—Western Electric Co., Ltd.
Laying conduits.—Hampton-Egham-Ascot (Sec. I) (Sec. II), London-Uxbridge-High Wycombe (S. Mid. Sec. III), and Stepney, &c.: J. Ewart, Ltd. Trafford Park: W. Pollett & Co. Sunbury: S. Kavanagh & Co. Nottingham (West Park): J. Mowlem & Co., Ltd. Tufnell Park: W. & C. French. Bexhill-Hastings, Hackney (Cazenove Road), and Gerrard Area (N.W. of Regent Street): H. Farrow. Cheshunt (Goffs Oak): Greig & Matthews. Finchley (Torrington Park): G. J. Anderson.
Motors.—Crypto Electrical Co., Ltd.
Motors and switchboard.—S. G. Leach & Co.
Telephone exchange equipment.—Stockport: Siemens Bros. & Co., Ltd. Norwich and Jesmond (Newcastle-on-Tyne): Western Electric Co., Ltd. Leeds: Automatic Telephone Manufacturing Co., Ltd. "Liverpool Courier" office, Liverpool: Relay Automatic Telephone Co., Ltd. Sub-contractors for batteries: D.P. Battery Co., Ltd.

High Commissioner for India.

Carbon pellets.—Peel Conner Telephone Works, Ltd.
Carsack elements.—Siemens Bros & Co.; General Electric Co., Ltd.
Ceiling fans.—Veritys, Ltd.
Electric fittings.—J. Stone & Co., Ltd.
Generating sets.—J. Birch & Co., Ltd.; Laurence Scott & Co.
Generator and spares.—Lancashire Dynamo & Motor Co., Ltd.
Switchboard.—Relay Automatic Telephone Co., Ltd.

Crown Agents for the Colonies.

Cable.—Johnson & Phillips, Ltd.; London Electric Wire Co. & Smiths, Ltd.; India Rubber, Gutta Percha & Telegraph Works Co., Ltd.
Copper wire, &c.—Shropshire Iron Co., Ltd.
Electrical material.—General Electric Co., Ltd.
Motors and switchgear.—British Thomson-Houston Co., Ltd.
Switchboard.—British Thomson-Houston Co., Ltd.
Telegraph line material.—Siemens Bros. & Co., Ltd.; Bullers, Ltd.
Telephone apparatus.—Western Electric Co., Ltd.
Telephone materials.—British L. M. Ericsson Manufacturing Co., Ltd.

H.M. Office of Works.

Engineering services.—Acton, Ministry of Pensions, switchgear: Drake and Gorham, Ltd. Bedford housing scheme, electric wiring: Alpha Manufacturing Co., Ltd. British Museum, additional generating plant: Crompton & Co., Ltd.; Grantham, Ministry of Pensions, hospital, Harrowby Camp, electric wiring: T. Clarke & Co., Ltd.

**London.** — HAMMERSMITH. — Electricity Committee. Recommended :—

Steel piping, &c., in connection with the installation of the first 10,000-kW turbine.—Foster Bros., £299.

Cable in connection with the supply of electricity to the Wormholt estate :—

1,000 yd. 15·3-core, 1,000 yd. ·1 do., 2,000 yd. 7/20 and 1,000 yd. 7/22 l.p. cable, £1,438.—Enfield Ediswan Cable Works.

Additional switchgear, £2,359.—Ferguson, Pailin, Ltd.

**New Zealand.**—The New Zealand Public Works Department has accepted the tender of S. Green, Ltd., of Sydney, amounting to £26,377, for the supply of copper cable in connection with the Waikato hydro-electric power undertaking.—*Reuter's Trade Service* (Melbourne).

## FORTHCOMING EVENTS.

**Institution of Civil Engineers.**—July 1st. At the Institution of Civil Engineers, Great George Street, Westminster. Engineering Conference.

**Institution of Mechanical Engineers.**—Friday, July 1st. At the Institution, Storey's Gate, S.W. At 10.30 a.m. London Summer Meeting.

**London Fair and Market**, at the Royal Agricultural Hall, Islington, N. July 4th to July 15th.

**Institution of Railway Signal Engineers.**—Thursday, July 7th. At the Midland Grand Hotel, London. At 6 p.m. Paper on "Problems of Automatic Train Control," by Mr. W. J. Thorrowgood.

## NOTES.

**A Gift for Scientific Research.**—*The Times* Paris correspondent says that Baron Edmond de Rothschild, member of the French Institute, has announced to the Académie des Sciences his intention to devote the sum of 10,000,000 fr. (£200,000) to the foundation of a laboratory of scientific research. The proposed institute will be chiefly devoted to the development of physical and chemical science, and its application to industry and agriculture.

**Service Notes.**—Commissioned Telegraphist W. G. Pulley-blank has been appointed to the battleship *Conqueror*, and Commissioned Telegraphist A. Boniface to the *Victory* (Nelson's old flagship), at Portsmouth, for Signal School duties, from the 27th inst. Warrant Telegraphist T. F. Perrow has been appointed to the *Vivid*, for Signal School ; Warrant Telegraphist E. W. Penny to the battle cruiser *Queen Elizabeth* ; Warrant Telegraphist W. Small to *Ganges II*, for Shotley Training Establishment ; Warrant Telegraphist H. Shirley to the destroyer *Malcolm* ; and Warrant Telegraphist F. Burnish to the light cruiser *Coventry*. Recruiting for the electrical departments of the Navy and Army is improving. Wireless men are still wanted, and the Royal Air Service is taking likely mechanics. There does not seem to be any immediate prospect of a reduction in the Air Force.

**Church Lighting.**—CORRECTION. — In an illustrated "Note" published in our issue of June 17th, under the above heading, the contractors were stated to be Messrs. Stanley Gaynor & Co., of Cardiff. This was an error, due to the fact that we received, at the same time, an illustration of the interior of a church wired by this firm. St. Saviour's Church, Bath, which we illustrated, was wired by Messrs. J. Lambert & Sons, of Bath.

**Fire.**—A fire in the Leven Creosote Works of Messrs. Alex. Bruce & Co., Ltd., Glasgow, destroyed valuable machinery and electrical plant recently installed.

**The Manchester Electro-Harmonic Society.**—We are pleased to learn from Mr. J. Hill, the Hon. Sec. of this Society, that it has been decided to resume the concerts this year. Some of our readers will remember that the Society was formed in 1912, and after two seasons operations were suspended owing to the war. Arrangements have been made for six concerts, and these will be held on the last Fridays of October, November, and December, 1921, and January, February, and March, 1922, in the Marble Hall, Albion Hotel, Piccadilly, Manchester. The hon. musical director, Mr. W. J. Smith, has consented to act for the season, and it is his intention to maintain the high quality of the programmes.

**Appointments Vacant.**—Electrical foreman, also electrical inspector (salary 500 Rs. per month in each case) for the East Indian Railway Co. ; station superintendent (£556) for the Coventry Corporation Electricity Department. See our advertisement pages to-day.

**The Electrical Trades Benevolent Institution.**—At a general meeting, held on Monday last, the alterations in the rules passed at the annual general meeting were confirmed. These alterations extend the powers of Local Advisory Committees with regard to the grant of relief in urgent cases.

**Educational.**—IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.—On Friday last Mr. A. J. Balfour opened a new chemistry laboratory presented by Mr. G. W. Whiffen, in which apparatus is installed reproducing on a smaller scale the plant of industrial works, to enable the student to work under conditions approximating to those met with in actual practice. He said that the new laboratory had no parallel in any part of the world.

**The Paris Underground Railways.**—As a consequence of the great changes wrought by the war, and particularly by the subsequent enormous increase in the sale prices of all kinds of materials and the large advances in wages, the companies which render service to the public in the French capital have found it necessary to seek a rearrangement of the terms of their original concessions which were granted to them by the Paris City Council. As was mentioned some time ago, the first to undergo reorganisation were the surface transport undertakings (tramways and omnibuses), which were expropriated by the City Council and formed into an amalgamated leasing company as from January 1st, 1921. The turn of the Compagnie Parisienne de Distribution d'Electricité has now arrived for the conclusion of a supplementary agreement with the City Council in order to meet the general changes in conditions, and a similar observation also applies to the Paris Gas Co. and the Metropolitan and Nord-Sud Railway Companies. It is estimated that the City Council has incurred an expenditure of 620,000,000 fr. on the construction of the tunnels, &c., for the Metropolitan railway and on incidental expenses, while the company's combined share and loan capital amounts to 200,000,000 fr.

The fact may be recorded that according to the law passed authorising the City of Paris to raise loans for the establishment of the Metropolitan Railway, all the expenditure for the construction of the underground earthworks (tunnels, &c.) and the station platforms, was placed to the charge of the city, whilst the other expenditure (the construction of the tracks and electrical transmission, the provision of access to the stations, the generating stations, rolling stock, &c.) had to be borne by the concessionnaire company, and represented nearly one-third of the total outlay on the entire railway undertaking. In order to provide for the annual interest upon the loans contracted by the city, the obligation was placed upon the company to pay to the city a royalty per passenger carried, the amount increasing in accordance with the number of tickets issued beyond a specified total, but in case the yield from this source should be inadequate to meet the service of the loans, the deficiency would be defrayed out of the general resources of the municipal Budget. But the Metropolitan Co. before the war, together with the gas undertaking, was said to represent the best financial transaction which the city had ever made, since it was always remunerative.

A new agreement has now been provisionally concluded between the company and the City Council under which the concession will definitely terminate in 1955 under what is termed "postponed redemption." The compensation to be paid for the purchase has been fixed by the operation of a system of premiums which represent both payment for the services of the company and the compensation for expropriation, and which are based upon the number of tickets issued and the economies effected in management. It is calculated that the premiums will produce an annuity of about 11,500,000 fr. at the beginning and 13,000,000 fr. subsequently, but if the amount should exceed the latter sum a large part of the excess would devolve upon the city. The new convention also makes provision for the possible expropriation of the railway as from the year 1931.

The situation of the Société du Nord-Sud Co. is materially different from that of the Metropolitan Co., as the former constructed its railway without any financial participation by the City of Paris, and its concession will expire at the end of 1955. In this case also the city receives a royalty per ticket issued and to some extent shares in the financial charges of the company.

**Power from a Water Main.** — The *Electrical News* recently published a description of a unique water power plant which is being installed at Port Alberni, B.C. The water supply station of this town was built on a scale of permanence, the supply being taken from China Creek, seven miles distant, and a main capable of maintaining a flow of water sufficient for a population of 20,000 people was installed. The first five miles of the main are of 16-in. wood-stave pipe. At the end of the 16-in. main is a 12-in. Crane pressure reducer, followed by 1¼ miles of 12-in. welded steel pipe, with a second pressure reducer about midway of its length. The size again changes at the head of the main street of the town to 10 in. steel, continuing to the end of this street at tide level, and serving the various laterals. A third pressure reducer is installed on this line, making the final pressure in the lower portion of the town usually about 160 lb. per sq. in. under present conditions of consumption—a rather excessive working pressure for a town supply system.

Investigations showed that absolute minimum flow in the main was 4 cu. ft. per second, whereas the requirement of a population double the size of that of the town was only .5 cu. ft. per second. It was decided, therefore, to utilise the surplus for generating electricity for the town. Consideration of alternative methods led to the decision that the best method of employing the surplus was to tap into the 10-in. section of the main and install 2,600 ft. of 10-in. wood-stave pipe leading to a power house.

The elevation of the dam being 610 feet, and that of the power house 25 ft. above sea level, the total head on the main at the power house was 585 ft., of which 252 ft. was lost in friction head, &c., leaving an effective head of 333 ft. Using 4 second-feet of water at 80 per cent. efficiency, this head

represented an available power of 121 h.p., sufficient to carry the lighting plant load for some time to come at the existing rate of increase.

It has been decided to install a 30-in. McKinnon special impulse waterwheel, fitted with hand-operated stream-deflector, needle nozzle, cast-iron lower and steel upper casing, overhung on a 3 7/16-in. shaft. The shaft will run in ring-oiled bearings on special adjustable pedestals, and a 36-in. flywheel of 800 lb. rim weight will be mounted on it, with a 26-in. diameter by 15-in. face driving pulley, provided with a disengaging spiral jaw clutch. The wheel will run at a normal speed of 475 r.p.m.

**Training Dominion Students in British Technical Colleges.**—The Department of Overseas Trade informs us that His Majesty's Trade Commissioners in South Africa have recently been considering the question of attracting young South Africans to British engineering and other technical colleges and training establishments in the United Kingdom, and in this connection Major Guy Fetherston, D.S.O., M.C., Trade Commissioner at Cape Town, has received from Prof. McMillan, of the Cape Town University, some remarks on the commercial advantages of the system, from which the following notes are extracted: It is known that the United States is most anxious to attract students, and especially post-graduate students, to its universities. No better method of increasing trade between the two countries exists. The South African goes to America as a student, he works with American machinery, and becomes acquainted with American methods and American standards, and he forms friendships there which probably last throughout his life. In due course the ex-student returns to South Africa to embark on a business career, still thinking in American measures, and even if he is inclined to deal in the products of other countries, in nine cases out of ten the American products remain as his standard for comparison of all other goods.

It is, of course, known that a large number of young South Africans proceed to England to complete their education, even more than go to America, but the greater proportion of these go to study medicine and law, or else they take a course for Bachelor of Arts at Oxford or Cambridge. America appears to be attracting the bulk of the agricultural students, the engineers, and the science men. The case of Germany before the war is interesting in this connection. Germany attracted the post-graduate student from all over the world, and there would appear to be little doubt that America is eventually to take her place unless Great Britain makes greater efforts than in the past.

It is, of course, understood that British universities are very full, and that there would be difficulty in accommodating more students from overseas. However, it would pay in the long run to attract overseas students, even if further accommodation had to be provided.

It is felt strongly that the manufacturers of the United Kingdom should do everything in their power to attract the future leaders of colonial industries to the British research laboratories, and even if they had to offer a number of maintenance scholarships to accomplish this, there could be no better capital investment for the future.

Then there is the question of the equipment of the universities and technical schools in South Africa. While a proportion of graduates proceed to America or to Europe for their practical training after their college course, a still greater number are absorbed direct from college into business. It is, therefore, in the interests of the United Kingdom that such men should handle British apparatus in the laboratories during their training, and every effort should be made by the representatives of the manufacturers to see that the testing plant and equipment is British. Before the war if a British firm and a German firm were asked to quote for some piece of apparatus or machine for use in a university, the German firm generally offered to supply it for less than the British firm, no matter how low the British tender was.

In connection with the above, it may be stated that the American Consul-General in Cape Town has recently given publicity to the fact that he has literature dealing with over one hundred American universities, agricultural, engineering, and other technical colleges, which may be consulted at the American Consulate-General. Information concerning entrance requirements, cost of tuition, cost of living, and the general opportunities for South African students existing at State and other institutions is offered. It is desirable that similar facilities with regard to British institutions should also be available, not only at Cape Town, but at other centres of population throughout the Empire. British educational institutions or firms supplying educational apparatus who are interested in the above statement, and who are prepared to supply information or apparatus, should communicate with the Department of Overseas Trade, referring to D.O.T. 5556/E.D.

**Ventilation Scheme for Polyphase Motors.**—To prevent the accumulation of oil on motor windings and the resulting collection of dirt, a line of polyphase induction motors has been brought out recently in which an unusual method of ventilation is used. The scheme is to screen the ventilating air before it enters the windings and so to direct this air that it opposes the entrance of oil into the windings from the waste-packed bearings. The waste-packed oiling method has been adopted also to overcome any tendency toward the spilling of oil when vibration is particularly severe.

While the motors are ventilated or air-cooled, they are virtually enclosed from a mechanical standpoint. Air enters at the periphery of the machine and is discharged at each end, the direction of air flow being exactly opposite to that found in most motors. It is claimed that oil leakage caused by careless filling cannot occasion bad results, because such oil is expelled from the ends of the motor instead of being driven into it.

These motors are provided with a novel frame or casing consisting of a series of corrugations formed from a single piece of sheet steel. These corrugations are equidistantly spaced and in intimate mechanical contact with the stator core, so that most of the heat generated in this core and its winding is conducted to this casing, which therefore forms an efficient means for transferring heat to the ventilated air by radiation. Air entering at any point along the surface of the screen travels over the outside of the corrugations through holes provided at the centre of these corrugations, then through the lateral ducts between the casing and core, then over the windings at the end, and finally is discharged at each end of the motor. This corrugated casing, therefore, contributes to the efficiency of the ventilating system to a marked degree and at the same time forms an exceedingly rigid and accurate frame for the stator core.

Fans are provided at the ends of the rotor for the purpose of drawing the cooling air through the machine. They are said to be of unique design and construction in that a stream of air is drawn directly over the bearing housings and immediately expelled without entering the motor, while another stream is drawn through the machine and expelled at the same points. These fans are made of a single piece of sheet steel and welded to the thrust collars.

The rotor windings have bars and end rings made of one piece of metal, entirely eliminating mechanical or electrical joints, the windings being moulded or cast on the magnetic core.

These motors are now built in sizes up to 30 h.p. at 1,800 r.p.m. for 60-cycle polyphase circuits, with corresponding capacities at other standard speeds and frequencies.—*Electrical World.*

**The Stability of Atoms.**—Prof. Sir E. Rutherford, F.R.S., commenced his lecture on the above subject to the members of the Physical Society of London, on June 10th, by referring to the earlier work in which attempts at the disintegration of atoms had been made. Traces of hydrogen and helium had been found in discharge tubes believed to be initially free from these gases; but it was clearly impossible to establish that no source of contamination was available, and that the results were due to disintegration of the atoms of other substances. The properties of the nucleus atom were then recalled and the method of attack most likely to succeed in breaking it up was discussed. It is easy to remove electrons, but these are replaced almost immediately and the atom remains as before. It is necessary therefore to attack the nucleus, and to do this successfully requires extremely swift particles.

Slides were shown illustrating the effects produced when ex-particles fired through hydrogen collide with an atom, and experiments were illustrated and described from which the conclusion has been drawn that when an ex-particle collides with a nitrogen atom, a hydrogen atom is expelled from the nucleus. The speed of these is in excess of what can be obtained by collisions in hydrogen gas itself, so that the result cannot be accounted for by contamination of the nitrogen with hydrogen, but must be due to the disintegration of the nitrogen nucleus. Recent results on the disintegration of aluminium and other elements were briefly indicated.

**The Engineering Wages Dispute.**—The result of the ballot in the engineering trades, upon the new schedule of wages proposed by the employers, was a decisive majority against acceptance. The figures were as follows:—Against acceptance, 257,532; for acceptance, 125,014; majority against acceptance, 132,518. In spite of these figures, however, it was announced early yesterday morning that a provisional agreement had been reached between the two parties to the dispute; no details are available up to the time of our going to press. Little more than one-third of the membership of the unions concerned took part in the voting.

## INSTITUTION NOTES.

**Institution of Mechanical Engineers.** — LONDON SUMMER MEETING.—A conference of an informal nature was commenced yesterday, and ends to-day, at the Institution building, dealing with means of improving the thermal efficiency of heat power plant; there was also an exhibition of boiler-house appliances, and a short meeting of the F.B.I. Fuel Economy Technical Sub-Committee was to be held to-day. Yesterday morning the general meeting took place, at which the president of the Institution, Capt. H. Riall Sankey, made his opening remarks, after which the deputation of American engineers, which is on a visit to this

country, was received. Visits of inspection were also to be paid to the following electricity generating stations:—Boroughs of Hammersmith and Stepney, Corporation of Kingston-upon-Thames, Underground Electric Railways Co., Ltd., Westminster Electric Supply Corporation, Ltd., and the Charing Cross, West-End, and City Electricity Supply Co., Ltd.; the laboratories at H.M. Fuel Research Station, Imperial College of Science and Technology, City and Guilds (Engineering) College, and the Department of Chemical Technology were also inspected. The papers read at the Conference dealt with the following subjects:—"Theory of Internal-combustion Engines with Relation to Thermal Efficiency," by Mr. H. E. Wimperis; "High Steam-pressure and other Means of Increasing Economy of Steam Engines," by Mr. F. Samuelson, who suggested that the addition of a mercury boiler and turbine to an ordinary steam plant would give a considerable increase in the range of temperature, and would result in a large gain in efficiency; he also gave practical results obtained from h.p. and high-temperature steam-turbine plant. Mr. E. V. Evans discussed the "Chemistry of Combustion," including the mode of combustion in producer and furnace-gas reactions and the cause of smoke production. A paper by Messrs. A. Hutchinson and F Bainbridge on "Blast-Furnace Gases," indicated the future lines of development in the use of a mixture of blast-furnace and coke-oven gases and the saving of coal thereby. "Boiler-house Management: General Causes of Boiler Inefficiency," was dealt with by Mr. D. Wilson, while the "Low-Temperature Carbonisation of Coal" was Prof. W. A. Bone's subject, and that of "Engine-house Management" Mr. H. Dunell's. The subject of "Super Compression and Other Means for Improving the Economy of Internal-Combustion Engines." was considered by Mr A. E. L. Chorlton; and that of "Waste Heat Utilisation," by Mr. R. Nelson, whose final conclusion was that "radical changes are better than limited and tentative reforms which tend merely to perpetuate the old order." "Superheating" was discussed by Sir H. Fowler, and "Liquid, Powdered, and Colloidal Fuels," by Dr. W. R. Ormandy, who enumerated their advantages and limitations, and compared their costs of adoption and relative prices. "Liquid Fuel for Internal-Combustion Engines" was Mr. H. Moore's subject, and Mr. A. W. Bennis dealt with "Automatic Stokers"; Mr. W. H. Patchell, with "Air Heaters"; Mr. C. E. Stromeyer, with "Feed Heating and Economisers"; and Prof. W. E. Dalby, with the "Indicator as an Aid to Economy."

**Royal Society of Arts.**—On June 27th the Council attended at Clarence House, when the Duke of Connaught, President of the Society, presented to Prof. J. A. Fleming, D.Sc., F.R.S., the Albert Medal of the Society awarded to him in recognition of his many valuable contributions to electrical science and its applications, and especially of his original invention of the thermionic valve.

**Municipal Tramways Association.**—In connection with the private meeting at Huddersfield, on June 22nd, of the Association (Managers' Section), Mr. R. H. Wilkinson, general manager of the Bradford tramways, read a paper on "Railless Trolley Traction," and on the following day the delegates proceeded to Bradford to see the latest type of railless vehicle in use there, produced from Mr. Wilkinson's designs.

**The Roentgen Society.**—The officers and Council elected for the 1920-21 session are as follows:—President, Prof. J. W. Nicholson, F.R.S.; Vice-Presidents, Mr. C. H. Rodman, M.D., Prof. Sir Ernest Rutherford, F.R.S., Prof. Sir William Bragg, K.B.E., F.R.S.; Hon. Treasurer, Mr. Geoffrey Pearce; Hon. Secretaries, Messrs. E. A. Owen, D.Sc., and J. Russell Reynolds, B.S., M.B.; Hon. Editor, Major G. W. C. Kaye, O.B.E., D.Sc.; Council, Mr. Cuthbert Andrews, Mr. Harold Black, M.D., Mr. A. E. Dean, Major Kenelm Edgcumbe, Mr. N. S. Finzi, M.B., Mr. F. L. Hopwood, D.Sc., Mr. F. Hernaman Johnson, M.D., Mr. Reginald Morton, M.D., Mr. C. E. S. Phillips, O.B.E., F.R.S.E., Prof. A. W. Porter, F.R.S., Prof. A. O. Rankine, O.B.E., D.Sc., Sir Archibald D. Reid, K.B.E., C.M.G.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

SIR SAMUEL C. DAVIDSON, K.B.E.—Sir Samuel Davidson, K.B.E., M.I Mech.E., chairman and managing director of the "Sirocco" Engineering Works, Belfast, upon whom the King conferred the honour of a Knighthood of the British Empire, is both a successful inventor and one of the oldest living representatives of the tea planting community. He took a keen interest in science and engineering from his earliest days. After he had spent several years in the office of Mr. Wm. Hastings, a Belfast civil engineer, his father sent him out to India to manage his tea estate. During his sojourn in the East he realised the inadequacy of the primitive methods then employed for tea manufacture, and practical experience, combined with his inventive genius, suggested to him the possibility of using mechanical apparatus for drying the tea leaf at the plantations. The result of his study of this subject promised so well that he subsequently gave up tea planting and returned to Ireland, where he founded the "Sirocco" Engineering Works. From these works he introduced to a sceptical community the first tea-drying machines, which met with great success. Sir Samuel Davidson has taken out a very large number of patents, and in addition to "Sirocco" machinery for every process in the manufacture of tea, his inventions include the "Sirocco" fan, so much used in factories and mines, and on board ship. Sir Samuel Davidson started the "Sirocco" Engineering Works in 1881 with one small workshop and seven workmen. The works are now very extensive and well equipped, and employ about 1,000 hands. There are also branches and representatives of the works in all parts of the world. Sir Samuel Davidson's latest invention consists of a new process for the manufacture of raw rubber, and of machines specially designed for the purpose. This process was shown for the first time at the recent Rubber Exhibition in London

SIR SAMUEL C. DAVIDSON, K.B.E.

Among other matters now receiving his attention is the manufacture of peat into briquette form. We offer Sir Samuel our congratulations upon the honour now conferred upon him. We regret to learn that owing to indisposition, he was unable to be present at the investiture ceremony and receive the honour personally.

MR. ALFRED S. E. ACKERMANN has removed to 17, Victoria Street, Westminster. His telephone number is still "Victoria, 244."

Over 100 applications have been received by the Wallasey Electricity Committee for the vacant position of electrical engineer to the Corporation. Seven candidates are to be interviewed by the Committee.

It is announced that DR. WALTHER RATHENAU, consequent upon his appointment as Minister for Reconstruction, has retired from the presidency of the A.E.G., and from the boards of other companies with which he was associated.

**Obituary.**—SIR H. B. ROWELL.—We regret to record that Sir Herbert Babington Rowell, K.B.E., chairman of Messrs. R. and W. Hawthorn, Leslie & Co., died suddenly on June 23rd, aged 61 years. Sir Herbert was a vice-president of the Federation of British Industries.

Our American namesake states that KARL G. ROEBLING, head of the John A. Roebling's Sons Co., Trenton, N.J., manufacturers of wire rope, insulated wire and cable, &c., died recently.

**Will.**—The late BARON MOULTON left £162,506.

## NEW COMPANIES REGISTERED.

**Pneumatic Power Users Co., Ltd.**—Private company. Registered June 17th. Capital, £500 in £1 shares. To carry on as agents, distributors and manufacturers of power producing machinery, &c. The first directors are: A. E. Porte, 27, Lower Leeson Street, Dublin; K. Beresford, 23, Leinster Road, Dublin; Mrs. S. M. Beresford, 23, Leinster Road, Dublin. Registered office: 27, Lower Leeson Street, Dublin.

**Colley & Co., Ltd.** (175,304).—Private company. Registered June 21st. Capital £2,500 in £1 shares. To carry on the business of electrical and general engineers and contractors, importers, exporters, manufacturers of and dealers in all kinds of electrical, gas, oil and lighting goods and accessories, &c. The subscribers (each with one share) are: H. A. Woodman, 51, Great Ormond Street, W.C.1, electrical engineer; G. McFarlane, 51, Great Ormond Street, W.C.1, electrical engineer. The subscribers are to appoint the first directors. Solicitor: H. Crafter, 7, Southampton Street, Bloomsbury Square, W.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**British Insulated & Helsby Cables, Ltd.** (52,285).—Return dated April 4th, 1921. Capital, £2,000,000 in £1 shares (500,000 preference, 1,000,000 ordinary and 500,000 unissued). 1,500,000 shares taken up. £1,072,675 paid on 372,350 preference and 700,325 ordinary shares. £427,325 considered as paid on 127,650 preference and 299,675 ordinary. Mortgages and charges, £700,000.

**Chiswick Electricity Supply Corporation, Ltd.** (38,854).—Return dated June 1st, 1921. Capital, £100,000 in £1 shares. 62,800 shares taken up. £62,800 paid. Mortgages and charges, £76,000.

**Heads (Electrical), Ltd.**—Debenture dated June 1st, 1921, to secure £400; charged on the company's property, present and future, including uncalled capital. Holder: Mrs. L. B. Head, 30, Goldsmid Road, Brighton.

**Hill Bros. (Magnetos), Ltd.**—Satisfaction in full on June 1st, 1921, of charge dated April 25th, 1918, securing all moneys due or to become due from company to bankers.

**Mansfield and District Tramways, Ltd.**—Trust deed dated June 6th, 1921, to secure £40,000 debentures, charged on 15,000 5 per cent. preference and 45,000 ordinary shares of £1 and £10,000 mortgage debentures and £10,000 mortgage debenture stock of the Mansfield and District Light Railway Co., Ltd., and the company's undertaking and assets, present and future, including uncalled capital. Trustees: Utilities and General Trust, Ltd., Edinburgh.

**Albert Lee & Co., Ltd.**—Issues of June 7th of £700 and on June 17th, 1921, of £900 debentures, parts of a series already registered.

**F. J. Shenton & Co., Ltd.**—Particulars of £6,500 debentures authorised June 18th, 1921; whole amount issued; charged on the company's property, present and future, including uncalled capital.

**Leadless White Manufacturing Co., Ltd.**—Particulars of a series of debentures for an amount not exceeding the issued capital for the time being of the company, authorised June 10th, 1921, amount of present issue being £3,000; charged (*a*) as a specific charge on the company's freehold property in Yate, Glos., and buildings, plant, machinery, fixtures and fittings thereon, and (*b*) as a floating charge on the company's undertaking and property, present and future, including uncalled capital.

**Stanton & Co., Ltd.**—Mortgage on certain land and premises in Hinckley, Leicestershire, dated June 10th, 1921, to secure all moneys due or to become due from company to London Joint City and Midland Bank, Ltd.

**F. Patrick, Ltd.**—Particulars of £4,000 debentures authorised June 14th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital. The company may mortgage any freehold or leasehold hereditaments subsequently acquired in priority to these debentures to the extent of £3,000.

## CITY NOTES.

**West India and Panama Telegraph Co., Ltd.**

The report for the year 1920 submitted at the annual meeting held on Wednesday, states that the amount to credit of revenue was £80,177, but the expenses were £138,325, resulting in a loss for the year of £58,148. The balance brought forward was £10,033, and interest on investments was £2,104, and the result was a net deficiency of £46,011 at December, 1920. The balance of the cost of the third survey of the company's cable ship, amounting to £38,579, also fell to be dealt with. Inasmuch as the total cost was £74,253, of which a part, £35,674, was dealt with in the 1919 accounts, the directors have added the £38,579 to the original cost of the ship, being satisfied that the increased amount at which she thus stands in the company's books is within her present commercial value. The unfortunate position of the company disclosed by these figures is due mainly to the cumulative results of entrusting the cable ship *Henry Holmes* to the Government Dock at Trinidad for her third survey repairs, and, in a lesser degree, to the increases in working expenses. As regards the main cause, it will be remembered that the *Henry Holmes* went to Trinidad in January, 1919. Before going there she had put the company's communications in good order, and for some period in the first half of that year her absence was not seriously felt and the traffic receipts were comparatively large. But in a cable system like that of this company breaks must occur from time to time, and, as it was only occasionally possible to secure the services of other repairing ships, the conditions gradually became worse and worse, so much so that in the spring of 1920, when it was found possible to charter a ship for five months, there were as many as 16 of the cables interrupted. Although the chartered ship worked well, some sections were still interrupted when the *Henry Holmes* was released from Trinidad, early in October last. It is a matter of experience that telegraph traffic, when lost, is recovered but slowly, and, although by the end of 1920 it was steadily moving towards recovery, the traffic receipts during the year were over £30,000 below those of 1919. Another consequence of the interruptions was the loss of over £10,000 of the Imperial, Canadian, and Colonial subsidies. The hiring of cable ships in the nine months cost at least £28,000 more than the expenses of the *Henry Holmes* would have amounted to; and there was also an expenditure of £2,109 in the hire of sloops for inter-colony communications. Of the increases in expenses an important one was in respect of cable. With such an accumulation of interruptions a large quantity of cable had to be used in repairs, of which the cost was £19,683, as compared with an average of £9,253 for each of the three preceding years. Another large increase was in respect of the *Henry Holmes*; the wages of the sailors and firemen had to be increased by over 40 per cent.; the cost of victualling increased 100 per cent., and the price of coal had been at least 60 per cent. higher than in 1918. There had also been some increase in the expenses at the stations, and it is probable that the high prices still prevailing in the West Indies may necessitate further increases this year. To meet the general heavy expenses in 1920, coupled with loss of revenue, it was necessary during the year to sell the bulk of the company's investments. Owing to the state of the money market the sales realised only £66,027 for securities which had cost £96,582. The investments now stand at £12,889, as against £109,471 at the end of 1919. The position of the company at the end of 1920 was so difficult that the directors decided to approach the Lords Commissioners of His Majesty's Treasury and ask for financial help. Their Lordships were unable to accede to the request for a special grant; but before the end of their financial year, they obtained the sanction of the House of Commons to the waiving of Clause 14 of the agreement of 1914, under which clause the company could have been called on to repay as much as £13,000 of the Imperial and Canadian subsidies, in respect of the year to September 30th, 1919. In consideration of this relief the directors agreed that whenever the cable between British Guiana and Trinidad is interrupted (as it is at present) the subsidy payable by British Guiana shall be reduced by three-fourths. For the first four months of this year the traffic receipts, although not as large as in 1919, show a considerable increase over 1920; and, now that the cable ship is available for repairs, it is hoped that will be no check on the growth of traffic. But in any event, in view of the debit balance of £76,566, there can be no question of any dividends for the year 1920; and the directors regret that, in their opinion, this debit balance must be completely disposed of before any dividends can be declared.

**British Electric Traction Co., Ltd.**

The annual meeting was held on Friday last at the Holborn Restaurant, Mr. J. S. Austen presiding. In proposing the adoption of the report, the chairman said it was not his intention to emulate Mr. Garcke, who usually gave a general résumé of the position of the electrical industry at that meeting. A year ago Mr. Garcke pointed out how the nature of the business done by the company had changed. In the past it had consisted in the construction of electrical undertakings, usually of a public utility nature, with the object of either selling or running them at a profit. To-day it was doubtful whether any electrical undertaking could be constructed with any prospect either of selling it or running it at a profit. It was true that electrical undertakings built before the war could now be operated at a profit, because, speaking generally, the fares and rates had been raised, but were similar undertakings to be built to-day, although it might be possible to run them without a loss, they would not be able to run them with any prospect of securing a fair return on the capital expenditure. That department of their business, therefore, had gone for the time being and they were now engaged in managing those companies of which they held control and in financing them. He need not tell them that every company needed more money to carry on its business as compared with the days before the war, and when it came to extensions of power companies, they had to be made at double pre-war costs. Those extensions were rendered necessary because the operative side of the board informed him that there was distinct evidence that the use of electricity was increasing. The coal strike had taught manufacturers the value of electrical power, and they had also found that it was cheaper to buy their power from a central station than to erect installations of their own. Proceeding to refer in detail to some of the undertakings in which the company had a large stake, he said that the Rio Grandense Light & Power Syndicate, Ltd., which supplied the city of Pelotas, in Brazil, was started before the war, but the tramways were not completed. Increased working costs rendered it necessary to apply to the city authorities for leave to increase the rates, and that permission was only obtained upon the condition that they completed a further portion of the tramway. The company was earning money, but it had been difficult to find the additional capital which was necessary for the extensions. With regard to the Brush Co., in order to maintain its business it was necessary for the board to extend its plant, and the B.E.T. Co. had, therefore, largely increased its interest in the company; it returned them 15 per cent. last year, so it was a profitable investment, and he hoped it would continue to be so. Then they had had to find the money for their calls upon the Stoll Film Co.'s shares. The necessary money had been found, chiefly by the sale of Northern Ontario Light & Power debenture and preference stock, war stock, and from the redemption of the debentures which they held in the Yorkshire Electric Tramways, Ltd. Referring to the omnibus business, he said that for a considerable time before the war the directors appreciated the value of motor 'buses in rural districts, and they formed the British Automobile Traction Co. Prior to the war, that company was earning a handsome rate of dividend, but when the war came most of its 'buses were taken from it, and although

it had continued to pay dividends, they were not of an important character. Since the war had been over the business had revived in a remarkable manner, and the returns were again of a very satisfactory character; but the rate of earnings did not exceed that which was obtained before the war. As to the results of the B.E.T. for the past year, there had been a small increase in the profit over that of the previous 12 months, but not sufficient to justify an increase in the dividend. Looking to the current year, they could not get rid of the fact that they were in the middle of a coal strike which had existed for many weeks. It was not so much the strike itself that they feared as its results which might continue to show themselves for years after it was settled. He did not feel that he could in any way forecast the future, but regarding the company as a trust company, he was convinced that it was all right, and that it would be a really successful and prosperous concern in the future.

Mr. E. Garcke seconded the motion, which was agreed to after a brief discussion.

**New General Traction Co., Ltd.**

The revenue for the year ended March, 1921, amounted to £19,486 and the expenditure, including debenture interest and income tax, to £8,501. The profit is thus £10,984, and £9,309 was brought forward, making £20,293. £10,480 is to be appropriated for the payment of a dividend of 4 per cent., less income tax, and £9,813 carried forward. The reports and accounts of the Norwich Electric Tramways Co. for the year ended June, 1920, and the Douglas Southern Electric Tramways, Ltd., for the year ended October, 1920, are annexed to the report. Notwithstanding the continued satisfactory expansion of the Norwich Electric Tramways traffics, the expenditure still further increased, mainly in wages, which were beyond the control of the management, resulting in a decrease of the net revenue. In view of the large amounts required for reconstruction of the track and renewal of equipment, the directors of that company considered it wise to pass the dividend and transfer the whole balance of profit to reserve for the above-mentioned purposes. On the other hand, the Douglas Tramways Co. has resumed payment of dividends on both classes of its shares. There is no change in the position of the guaranteed investment in the Philadelphia undertaking (the Darby, Media & Chester Street Railway Co.), but the course of sterling exchange has again further materially benefited the company in its remittances to this country of the dollar interest and dividend.

**Imperial Tramways Co., Ltd.**

In their report for 1920, the directors give details of the operations of the subsidiary companies. The gross receipts of the Middlesbrough, Stockton & Thornaby Electric Tramways amounted to £140,447, as compared with £114,260, an increase of £26,188. The total number of passengers carried was 15,626,562, an increase of 667,061. The net profit for the year was £19,466, as compared with £14,498 for the corresponding period. In connection with the acquisition of the undertaking by the Corporations of Middlesbrough, Stockton, and Thornaby, in accordance with the provisions of Section 43 of the Tramways Act, 1870, the arbitrator, Sir Robert Elliott-Cooper, K.C.B., awarded the company sums which, including the item of consumable stores, amounted in the total to £415,380, and also directed that the Corporations should pay the costs of the arbitration. The Corporations took steps to submit to the Court certain questions arising on the award, but ultimately discontinued the proceedings. The settlement of the purchase was, therefore, duly completed, and the undertaking transferred to the Corporations on April 2nd of the present year. The Corris Railway Co. showed an increase in receipts of £1,065, while the working expenses increased by £1,473. The holding of the Imperial Co. in the London & Suburban Co. remains the same, viz., 125,000 5 per cent. cumulative preference shares of £1 each, and 122,120 ordinary shares of £1 each. For the year 1920 the revenue of the latter company was again insufficient to enable the payment of any dividend on either preference or ordinary capital. The Imperial Co.'s net revenue account for the year shows an available balance of £24,841, and after payment of debenture stock interest and 6 per cent. preference dividend (less tax) for the year, 4 per cent. for the year is to be paid on the ordinary capital, leaving £1,391 to carry forward.

**Globe Telegraph and Trust Co., Ltd.**

Sir John Denison-Pender, G.B.E., (chairman), presided at the annual meeting on June 21st. He said that the year had been a successful one, but, in order to pay full dividends, £10,000 had been transferred to revenue account from reserve, reducing the latter to £78,000; 52,685 of the 60,376 new shares had been taken up by the ordinary shareholders, and the Eastern Telegraph Co. took over 1,588, the balance remaining unissued. The total cost of new shares in the Eastern, Eastern Extension, and Western Telegraph Companies was £803,416. Of this amount, the new shares issued and the sale of South American Telegraph Co.'s shares brought in £748,715, leaving £54,701 to be provided on capital account. To meet this amount £60,000 had been borrowed. The chairman referred to the sale of the interests of the United States Cable Co. to the British Government, and stated that the company was at present paying a dividend of 4 per cent. per annum. Increased receipts were obtained from the Eastern, Eastern Extension and Western Telegraph Co.'s owing to the allotment of new shares, but the full 10 per cent. had not been received on the holdings. The Great Northern Telegraph Co. had increased its dividend from 22 to 24 per cent. The return of shares temporarily held by the Government, which paid an added interest of ½ per cent., represented a loss of £950 to the company. The appreciation of the company's securities over the original capital invested was about £1,500,000.

**Brisbane Electric Tramways Investment Co., Ltd.**

The twentieth annual general meeting was held on June 15th, Mr. H. R. Beeton, the chairman of the company, presiding. The chairman said that the total receipts of the Brisbane Tramways Co. were £561,265, as compared with £476,386 for 1919; the total expenditure was £448,965, as compared with £361,985 for the previous year, and the net profit was £112,300, which, with £34,161 brought in from 1919, left an available balance of £146,460. Of this amount £8,000 had been credited to depreciation of investments fund, bringing that fund up to £15,500, and £115,000 had been applied in payment of a dividend, leaving £23,461 to be carried forward. The net balance of revenue account of the Investment Co. available was £147,543. After allocating £8,000 to the depreciation of investments fund, bringing it up to £11,500, and £20,000 to the reserve fund, bringing it up to £160,000, and providing for debenture stock interest and preference dividend, and 8 per cent on the ordinary shares, there remained to carry forward £42,837, subject to corporation profits tax. Owing to the Queensland Government not acquiring the tramways, as they announced they would do in October last, the board had to come to an arrangement with the debenture stockholders postponing the redemption of the debenture stock, which became due on January 1st, 1921, until January 1st, 1924, raising the rate of interest from 4½ per cent. to 8 per cent. per annum, and stipulating that a premium of 2 per cent. should be payable in the event of the debenture stock being redeemed before expiry. The bulk of the increased expenditure was due to continuous increases in wages. The Government had passed an Act, entitled the Profiteering Prevention Act, enabling them to depreciate the tramways by fixing fares at their absolute discretion regardless of the rights of the company. In March last year the Tramways Purchase Act, which had been twice rejected by the Legislative Council, was passed. The directors had had several interviews with Mr. Theodore, at which they conveyed to him that the company in no way demurred to the principle of expropriation, but only claimed to be fairly treated, and that they relied on him to apply the provisions of the Purchase Act in a manner which would do justice to the company and redound to the credit of Queensland. Mr. Theodore expressed his desire to protect investors to the best of his ability, promising, among other things, that the debentures, in which payment might have to be made, would be taken at their market price at the date of settlement, that whatever might be necessary to constitute them trustee securities would be done, and that interest at 6 per cent. per annum on the purchase price, as ultimately settled, would be paid from the date of taking over the undertaking until the date of payment. The Government, however, found themselves confronted with the prospect of not only having to issue 6 per cent. debentures at market price to an unexpected amount, but also of raising a large amount of new capital at a time when their exiguous financial resources were strained to the utmost to meet their pressing liabilities. In these circumstances, a policy of postponement was obviously indicated, and after some delay the State Treasurer announced that the Government would only acquire the tramways "at their convenience." The so-called Profiteering Prevention Act did not define profiteering and was administered at the absolute discretion of the Executive Government. The directors had entered a strong protest against this abridgment of the company's rights conferred by the General Acts of 1882 and 1890, under which it was constituted, and confirmed by the Government under the special Act of 1913.

**Lisbon Electric Tramways, Ltd.**

The directors have issued their report covering the years 1919 and 1920, together with balance sheets for both years. For 1919 there was a net profit of £74,505, but for 1920 a net loss of £120,006, the net loss on the two years' working being £45,500. The balance to the credit of profit and loss account brought forward from 1918 was £11,229, and the balance to the credit of the exchange reserve £15,000, thus leaving to be carried forward to the debit of next year's profit and loss account £19,271. The passengers carried during 1919 were 92,143,345, and the receipts Esc. 4,454,174; in 1920 they were 80,567,940, and the receipts Esc. 6,088,286; while in 1918 they were 80,806,364 and the receipts Esc. 3,523,069. The decrease in passengers in 1920 was due to the strike, from the end of July until the beginning of September, when the service was entirely suspended, and also to some small falling off from the increased fares. Expenditure has again considerably increased, viz.: 1918, Esc. 3,002,536$74; 1919, Esc. 3,294,241$26; 1920, Esc. 8,808,594$63. The rate of exchange which stood at 34d. on January 1st, 1919, had fallen to 20d. on December 31st, 1919, and by December 31st, 1920, to 6¾d. The heavy increase in the expenses in 1920 was not only brought about by the higher wages paid and the increased cost of all local supplies; it was particularly accen-

tuated by the cost of all those supplies which had to be purchased outside of Portugal at enhanced prices, this cost having to be ultimately borne in the very depreciated currency of that country. On account of the disastrous collapse in exchange during the period under review, it had been necessary to make applications to the Camara from time to time for increases of the tariff, with the result that only partial relief had been granted, and this after the greatest difficulty and prolonged negotiations. The last increase of fares obtained was put into force in December last, but as this was totally inadequate to meet the expenditure, an application had been made to the Camara for a further advance, which it was hoped would soon be granted. "The granting of the application by the Camara is one of urgent necessity, and permits of no delay if the public is to continue to receive tramway facilities as heretofore, it being self-evident that the service cannot continue to be run at a loss."

**United Electric Tramways of Montevideo, Ltd.**

The seventeenth ordinary general meeting was held on June 16th, Sir George A. Touche, Bart. (chairman), presiding. The chairman, in moving the adoption of the report and accounts and the payment of the dividends, said that receipts again showed an increase. Unfortunately, expenses had increased too, and had absorbed 72,45 per cent. of the gross increase. The increase was due mainly to higher wages, and there was little prospect of this item being reduced. Another important factor was the serious fall in the value of the dollar. Uruguayan currency had a remarkable record for stability. Being on a gold basis, for many years before the war it hardly varied at all. The normal rate of exchange was $4.7 to the pound, or 51d. to the dollar. During the past year it fell as low as 39d. to the dollar, and was now only 42¼d. This depreciation had naturally affected remittances. In spite of additional burdens, the company had not yet received permission from the Government to increase its tariffs. This had been granted to tramway and transport companies by other countries—all over the world, in fact—but not by Uruguay. Throughout the year every endeavour had been made to obtain a settlement of this all-important question, but without any result, although it had been before the Chambers for discussion many times. The poverty of the returns to the shareholders showed how irresistible was the company's claim to a revision of tariffs. The directors had every sympathy with the desire of the men for a better wage. It was in their best interests that an increase in fares was necessary, as the fares provided the only fund from which wages could be paid. The more restricted the fund the less must be the wage increase. The speaker took the opportunity of saying how admirably legitimate British interests were watched by Sir Claude Mallet, the British Minister, without in any way trespassing on territory which was not his or doing anything to antagonise local rights and susceptibilities. The profit and loss account showed a balance of £74,906. The balance brought forward was £7,932, making a total credit balance of £81,938. £5,961 had been set aside for the redemption of debenture stock and £2,500 for the preference and ordinary share capital redemption fund. This fund was invested separately, and the cost of investments was shown in the balance sheet at £23,424. These investments were chiefly in British Government Bonds, and present quotations showed a depreciation of 10 per cent. The sum of £30,000 had been placed to the renewals and contingency account. The dividends were a poor yield in a year of record takings, but the legalised impositions, for which, as yet, the company had had no compensation, were responsible.

The motion was carried unanimously.

A meeting of the first debenture stockholders was then held, at which the appointment of Mr. George Norman Touche as trustee was confirmed.

**The Australian English Electric Co.**

According to the *Sydney Morning Herald* a net profit of £26,750 was shown by the English Electric Co., Ltd. (formerly Standard Waygood Hercules), for the year ended March 31st, and with £3,559 brought forward from the old company £30,300 was available. In view of the large amount of money required to complete the company's new workshops and equip them with plant, and the cost of financing current business, no dividend was recommended while the financial stringency continued. To conserve the goodwill of the lift business a company has been registered under the name of Standard, Waygood, Ltd., with a nominal capital of £100,000. The stock belonging to the department will be represented by shares which will belong to the English Electric Co. G. Weymouth Pty., Ltd., has been reconstructed under the name of Weymouths, Ltd. Out of the funds provided for the purpose by the debenture issue (£108,000 plus £5,600 since issued, £113,600) the English Electric Co. had spent in workshops and equipment at date of balance £110,728. It was, therefore, proposed to issue the balance of the debentures created, viz., £36,400. The directors stated that they passed the dividend with the greatest reluctance. A good profit had been made and the company had the money. But the board did not know how its proposals for fresh capital might be received or whether assets which were liquid a few months ago were now saleable even at much reduced prices. Hence the board had decided upon a conservative policy, although, as some of the board were the largest shareholders in the company, their own interests were affected.

**Barcelona Traction, Light and Power Co.**

The report for 1920 states that the net revenue was $2,731,769. Interest payable in cash on bonds for 1920 amounted to $1,963,485. Usual provision was made for amortisation of underlying bonds, and in addition reserves for depreciation were made by chief operating companies, as follows: Light and power companies, $655,820; railway company, $283,364. In December, 1920, £1,050,000 of 8 per cent. secured debentures were sold in London, and with the proceeds £1,915,500 of outstanding 6 per cent. prior lien "B" bonds were acquired. The difference in the nominal amount of 8 per cent. secured debentures sold and "B" bonds acquired, £865,500, has been placed to capital reserve, as "B" bonds acquired are held as security for 8 per cent. secured debentures. The board during 1920 was able to liquidate all loans, which at December, 1919, amounted to $1,094,706. There was an increase of 6,128,683 pesetas in gross earnings of combined enterprises of companies operating in Spain, and net earnings increased 5,044,321 pesetas. With the completion of new hydro-electric installation at Camarasa, the major construction projects of Ebro company may be regarded as realised.

**Swedish Telephone Undertakings Abroad.**

The reports for 1920 have been issued by the three telephone companies which are incorporated in the Swedish-Danish-Russian Telephone Co., which owns the telephone system in Moscow, the Cedergren Telephone Co., in whose hands the Warsaw network is vested, and the Mexican Ericsson Telephone Co., which carries on the exchange system in the city of Mexico.

The report of the Mexican company states that operations proceeded in a satisfactory manner, and the number of subscribers increased from 12,680 in 1919 to 13,892 last year, and a further augmentation has taken place in the current year notwithstanding the higher rentals which were sanctioned by the Government last autumn. As in the immediately preceding years, so in 1920 was the circulating medium formed of metallic currency, and the still prevailing advantageous conditions between the Mexican and Swedish exchange yielded considerable profits in exchange in connection with the remittances. The net profits amounted to 361,576 gold pesos, as compared with 260,925 pesos in 1919, and the directors propose to pay a dividend at the rate of 7 per cent., as contrasted with 6 per cent., and an addition of 4 per cent. (2 per cent. in 1919) for profits arising from exchange.

Concerning the Svensk-Dansk-Ryska Telephone Co., the report states that it was naturally impossible to carry on any business whatever in Russia last year, and it was still impossible for the directors to enter into direct negotiations with the Russian authorities for the regulation of payment for the company's assets in Moscow, which were taken over by the Imperial Government in the year of 1917. The development of circumstances, however, were being followed by the directors in order to be able to put the matter forward on the first possible opportunity. On this basis a loss of 1,365,613 kr. was incurred last year, as compared with 1,294,074 kr. in 1919, chiefly on account of interest payments on the company's loan. The telephone system at Moscow is still entered in the company's books at its original cost of installation of 51,400,000 kr. The balance sheet of the Moscow department closes at 65,500,000 kr., as against 61,800,000 kr. in 1919, with a balanced loss of 4,100,000 kr. for the years 1917 to 1920, while the Stockholm department closes at 16,900,000 kr., as compared with 29,400,000 kr., with a loss of 3,374 kr. for 1920.

As to the Warsaw system, the report states that the activity of the Cedergren Telephone Co. suffered from the uncertain and depressed political and economic conditions which prevailed in Poland last year. The working expenses greatly increased as a consequence of the increasing fall in Polish currency—wages alone were five times greater at the end than at the beginning of the year—while the considerable increases in the subscription rates which were made every quarter were only able to defray the working expenses, but were insufficient to cover the interest on the company's loan. As a result the year showed a loss of 903,000 kr., as compared with a loss of 1,889,000 kr. in 1919, the total losses for the years 1916 to 1920 consequently rising to 6,378,000 kr.

**The Austrian Siemens-Schuckert Works.**

The directors of the Austrian Siemens-Schuckert Works Co., of Vienna, report that as a result of the better food supplies and the improvement in the willingness to work, the efficiency of the individual workman in 1920 was raised a considerable degree nearer to the pre-war level. Notwithstanding many critical events it was possible adequately to occupy the workshops; and the decline in Austrian orders and in orders from the Succession States was equalised by the cultivation of new business connections abroad. The first contracts, although of small extent, were received for the electrification of individual Austrian State railways. Sufficient orders, particularly for export, were on hand in the new financial year, so that it was expected that the shops would be occupied to the same extent as in 1920. A power station and 20 main line locomotives had been ordered by the Austrian State railways, although these would only be executed next year on the completion of the preparatory works. Sale prices had now reached the parity of the world's market prices, and had consequently to follow those of keen foreign competitors,

while rivalry was expected further to increase owing to the reduced purchasing power of customers. The number of workmen and officials employed was 5,209 at the end of 1920, as compared with 4,947 at the close of the preceding year. After applying 1,400,000 kr. to depreciation, as against 1,400,000 kr. in 1919, the accounts indicate net profits of 8,016,000 kr., as contrasted with 3,061,000 kr., and a dividend at the rate of 8 per cent. has been declared, comparing with 5 per cent. in 1919. It has now been decided to increase the share capital by 75,000,000 kr. to 200,000,000 kr. to provide the funds necessary for the undistributed maintenance of working and the acquisition of stocks.

**The Swedish Ericsson Telephone Co.**

The report of the directors of the Allmänna Telefon Aktiebolag L. M. Ericsson for 1920 states that as in the immediately preceding years, the high costs of production which were increased by the law introducing an eight-hour day, placed the company in an unfavourable position in competing in the world's markets. In order to maintain its position in these markets and retain the old circle of customers, the company was compelled to keep its sale prices on a lower level than was warranted by the costs of production. The result was that the volume of sales was satisfactory. At the beginning of 1920 the orders on hand represented about 10,000,000 kr., and at the close of the year they reached 17,000,000 kr. A reduction in the cost of production, however, was indispensable if these circumstances were to continue in the new financial year, and some steps in this direction had already been taken. The number of workmen at the Stockholm shops increased from 1,359 to 1,644 during the year. The value of the turnover was 14,843,000 kr., as compared with 15,775,000 kr. in 1919, the exports included in these totals having comprised 10,685,000 kr. (72 per cent.) and 10,843,000 kr. (68.7 per cent.) in the two years respectively.

Concerning the subsidiary manufacturing companies, the report states that the Petrograd workshops of the Russian Ericsson company continued to be immune from damage, and work was being still carried on for the account of the Soviet Government under the management of its delegate. The English company was well occupied in 1920 and the dividend on the ordinary shares was at the rate of 8 per cent. The Austrian and Hungarian companies were fully and profitably occupied, although the prevailing exchange conditions occasioned difficulties and rendered it impossible for remittances to be made to the parent company; their dividends would be at least 20 per cent. for 1920. The activity of the French company developed satisfactorily in the first nine months, but towards the close of the year the company was affected by the general depression, and no profits were realised. The stocks of raw and semi-finished materials held by the Swedish company at the end of the year were entered at such values that they could be secure even if a further fall in prices took place. As to the shares held in certain other companies, the report states that these must now be considered as of no value, and the holdings in the Swedish Air Traffic Co., the Svenska Radio Co., the Elektrolyte Works, the Triton Co., and the American subsidiary company had each been written down to one kroner. The accounts for 1920 show a loss of 3,322,000 kr., as contrasted with net profits of 3,753,000 kr. in 1919. The loss is due to the necessity for writing off 1,429,000 kr. on the company's stocks in Russia and of 3,695,000 kr. on shares, as just mentioned, chiefly in the American company.

The directors add to the report a supplementary statement relating to the reconstruction of the company consequent upon the situation of the Russian subsidiary. It was necessary, they say, to write off these shares, while debts owing by the latter would remain in the books at the amount at which they stood at present. On the other hand, by relying upon the reserve fund and one-half of the share capital, a guarantee fund would be formed sufficient to cover the amount of these claims. The total sum consequently written off the various Russian share interests is 6,594,000 kr., which is covered by the reserve fund, leaving 38,264 kr. to be carried to the guarantee fund in question which, including one-half of the share capital, will then reach 36,938,000 kr. The Russian credits to be covered by this fund are claims against bills of the Swedish-Danish-Russian Telephone Co. for 19,661,000 kr., and 15,084,000 kr. in other claims against the Russian subsidiary; the bank debts 85,803 kr., and claims for telephone works 2,106,000 kr. If approved by the shareholders the result of these operations will be a reduction in the ordinary share capital from 73,800,000 kr. to 36,900,000 kr., and the formation of a guarantee fund for 36,940,000 kr.

**French Companies.**

*The Société Appareillage Electrique Genteur* has decided to raise its capital from 1,000,000 to 3,000,000 fr., and to issue on a suitable date bonds to a total of 200,000 fr.

*Electricité et Gaz du Nord.*—The profits of the working year closing September 30th last, which totalled 2,620,295 fr., after allotting 617,685 fr. to the sinking fund, and allowing of a distribution of 12.50 fr. per share and 19.28 fr. per part, were obtained solely by means of the Jeumont station and the gas works. The outcome of the present year will be much larger, for, besides the enlargements to meet existing demands of the Jeumont works, other productive elements will yield their quota. The Lille station, for instance, started at the end of January, and the Maubeuge station was to be available in April. As to shares in other concerns, the Société d'Electricité de la Région de Valenciennes-Anzin obtained results in its financial year closing with December 31st last, which permitted it to enter a dividend-paying period; and the Société Gaz et Electricité du Hainaut was in an extremely favourable situation owing to the increased tariffs sanctioned, and the starting in August last of the Ville-sur-Haisne works, and the improvements and extensions of its plants at its several stations.

*Compagnie Centrale d'Energie Electrique.*—The report presented at the ordinary meeting showed that the output of electricity of the stations serving the Rouen district had advanced from 42,944,400 kWh in 1919 to 46,057,950 kWh in 1920. The increase would have been greater but for the rise in the price of coal and the crisis in various industries shown towards the end of the year. The management had devoted all its energies to realise the plans laid down in 1918, and revised in 1920, including the erection of four new boilers at the Grand Quevilly station, of four groups of 6,000-kW turbo-alternators, of two groups, 10,000 kW each, of Schneider-Thomson, and the establishment of two main lines —one from Grand Quevilly to Monvilly and the other from Grand Quevilly to Elbœuf. The meeting fixed the dividend payable at 20 fr. per share. The profit and loss account showed a balance of 850,086 fr.; receipts 36,984,462 fr., and expenditure 21,744,465 fr.

*Compagnie réunies de Gaz et d'Electricité.*—The ordinary meeting of this society, held at Lyons on April 5th, voted a dividend of 7 fr. per share, and authorised its board to issue bonds to the extent of 14,000,000 fr.

**Italian Companies.**

*Società anonima Elettricità Alta Italia.*—(Turin).—After reference to the regularly-effected increase of the capital of the company, which now stands at 48,000,000 lire, the report set forth the steady expansion of the company's business, its network now extending throughout the province of Piedmont either directly or through the medium of controlled companies. Thanks to suitable agreements with the Swiss group, the company had conveniently systematised its obligations. The financial year closing with December 31st had given a useful net balance of 3,788,957 lire, which allowed of a dividend of 6.80 per cent., or 17 lire per share.

*Società idroelettrica Piemonte* (Turin).—The yearly report of this company, after allusion to the exaggerated price of raw materials and the increase in staff wages, which had affected the balance, referred to the large share which the company had taken in the Società Idroelettrica Monviso and the Società Idroelettrica Piemontese-Lombarda Ernesta Breda, which assured to them a further 150,000 h.p. or over half a milliard kWh. The accounts closed with an available balance of 3,269,556 lire, which enabled a distribution of 7 per cent., or 8.75 lire per share.

*Società Ligure Toscana di Elettricità* (Leghorn).—The last report of this company, whose capital is 100,000,000 lire, shows that notwithstanding the hindrances of many kinds encountered, especially the agitations of the workmen, the production of 1920 exceeded that of the preceding year by 7,500,000 kWh. The erection of new plant was proceeding actively despite the scarcity of material, difficulties of transport, &c. The accounts closed to December 31st last with a net balance of 5,454,410 lire, which allowed of a distribution of 8 per cent.

**German Companies.**

*The Kabelwerk Wilhelminenhog*, of Berlin, which belongs to the Felten & Guilleaume group, reports net profits of 1,860,000 marks for 1920, as compared with 580,000 marks in the prevous years.

*The Dr. Paul Meyer A.G.*, of Berlin, proposes to pay a dividend at the rate of 12 per cent. for 1920 on share capital of 12,000,000 marks, this comparing with 10 per cent. in the previous year. The share capital is now to be increased to 24,000,000 marks.

*The A.G. fur Elektrotechnische Unternehmungen*, of Munich, reports net profits of 171,000 marks for 1920, as compared with 26,000 marks in the preceding year, and a dividend at the rate of 4 per cent. on the ordinary shares, which received no distribution for 1919.

The accounts of the *Treuhand Bank fur die Elektrische Industrie A.G.*, of Berlin, indicate net profits of 1,684,000 marks, as contrasted with 948,000 marks in 1919, which sum was reached after extinguishing the deficit of 1,139,000 marks brought forward from the previous year. It is intended to pay a dividend at the rate of 6 per cent. on share capital of 25,000,000 marks, as compared with the same rate on about half this capital in 1919.

The report of *Hartmann & Braun A.G.*, of Frankfort-on-Main, states that the degree of activity in 1920 showed a considerable improvement over the preceding year, but it was much less than in the pre-war period. Besides the exports to neutral countries, the operations of the Electro-Installation Material Co., a subsidiary of the company, contributed towards the better results. After making provision for depreciation, the accounts show net profits of 1,223,000 marks, as against 267,000 marks, and the directors recommend a dividend at the rate of 10 per cent., this contrasting with 6 per cent. in 1919.

The report of the *Bergmann Elektrizitatswerke A.G.*, of Berlin, states that the central station department obtained considerable orders in 1920 through participation in schemes for the electrification of the States and provinces, and the

railway department was fully occupied both for main line and light railway work. A tube rolling mill was added to the metal works and was developing satisfactorily, orders being on hand until the end of 1921. After writing off 4,828,000 marks for depreciation, as against 1,937,000 marks in 1919, the accounts show net profits of 13,135,000 marks, as compared with 8,488,000 marks in the preceding year, and the dividend is increased from 12 per cent. in 1919 to 15 per cent. in 1920. At the recent annual meeting, when it was decided to increase the ordinary share capital from 80,000,000 to 100,000,000 marks, it was mentioned that the prospects for the new financial year were very favourable, and the existing orders would provide activity for months forward. The foreign engineering and sales offices have been extended so as to promote the export trade.

**Belgian Companies.**

The Société d'Electricité et de Mécanique (Procédés Thomson-Houston et Carels), of Ghent, an amalgamation of the Belgian Thomson-Houston electrical engineering business with the engineering undertaking of Carels Frères, last week invited applications for 24,500 shares of 500 francs, representing an increase of capital of 12,250,000 francs, the shares being offered at 650 francs each. Since the war the works of the company in Ghent have been remodelled and largely extended. At the commencement of the present year the company was turning out large numbers of electric motors, transformers, and other electrical apparatus, while in the engineering shops extensive orders were in progress for Diesel and steam engines. Over 90 per cent. of the work in hand in this department was for foreign countries. The company has a board of 26 directors, among them being Mr. Howard C. Levis, the managing director of the British Thomson-Houston Co., Ltd., London.

The report of the Société d'Electricité du Bassin de Charleroi for last year shows a profit of 511,718 francs, as compared with 400,489 francs in the preceding 12 months.

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**Altrincham Electric Supply Co., Ltd.**—During 1920 169 new installations were connected, making the total 2,128. After providing for debenture interest, putting £500 to depreciation, writing £1,537 off the expenses of the ordinary share issue, a final dividend of 7½ per cent. per annum for the December half-year is paid on the ordinary shares, and 10s. for the year on the deferred shares, leaving £1,034 to be carried forward. In spite of many adverse circumstances, the profits continue to increase. The additional plant will be ready in the course of the next few months, and should effect further economies in generating costs. The above results were secured in spite of the falling off in demand for power due to industrial conditions. The outlook for the future is favourable. The times are not propitious for making a new issue of capital, but this will have to be seen to when conditions improve. Mr. C. E. Hunter has resigned from the board.

**Waygood-Otis, Ltd.**—At the annual meeting, held on June 22nd, the chairman (Mr. Henry C. Walker) said that, although the profit made would seem to allow of the payment of a higher dividend, 9 per cent. would be paid on the ordinary shares, as, owing to the falling off in business, it was considered wise to conserve their resources. The company had many important contracts in hand, including orders from Selfridge & Co., and John Barker & Co., and a contract for installing passenger lifts in the new County Hall of the L.C.C.

**Manaos Tramways & Light Co., Ltd.**—The receiver and manager who was appointed on June 10th, announces that owing to the unprecedented fall in the sterling value of the Brazilian currency it is not possible for the interest due July 1st on the 5 per cent. debentures to be paid.—*Financial News.*

**Victoria Falls & Transvaal Power Co.**—The "Financial Times" states that the net earnings, including those of the Rand Mines Power Supply Co., for the quarter ended March 31st amounted to £172,390, before providing for taxation in South Africa and the United Kingdom.

**Argentine Tramways & Power Co.**—The accounts for the year ended September, 1920, show that after payment of interest and sinking fund on debenture stock, and transferring £4,000 to reserve for renewals, there is a profit of £9,569, increasing the credit balance carried forward to £18,324, subject to corporation tax, if any.

**Montreal Power Companies.**—The Montreal Light, Heat and Power Co. is paying a dividend on the common shares of $2., and the Montreal Light, Heat & Power Consolidated Co. one of $1¼.

**Eastern Extension, Australasia & China Telegraph Co., Ltd.**—Interim dividend, for the three months ended March 31st last, of 5s. per share, free of income tax.

**Tramways & Light Railways Estates, Ltd.**—Dividend at the rate of 3 per cent. per annum; carried forward £213.

**Stock Exchange Notice.**—Deadings in the following securities have been specially allowed by the Committee under Temporary Regulation 4 (3):—

Pernambuco Tramways & Power Co.—£500,000 8 per cent. prior lien debentures to bearer, of £100 each, issued at 96 per cent., of which £30 is paid and fully paid, Nos. 1 to 5,000.

**Edgar Allen & Co., Ltd.**—Final dividend of 1s. per share, free of tax, making 2s. per share. £80,246 carried forward.

**Companies Struck off the Register.**—The following, it is officially announced, have been struck off the Register and are dissolved:—

A.B. Vibro & Domestic Electrics, Ltd.
Feltham & District Electric Lighting Co., Ltd.
Non-conductors, Ltd.
Snyder Electric Furnace Co., Ltd.
Wholesale Battery Co., Ltd.
Carbonite, Ltd.

**Major & Co., Ltd.**—Final dividend of 4½ per cent. on the preferred ordinary shares, making 8 per cent. for the year; 10 per cent. on the ordinary shares for the year; £6,479 carried forward.

## STOCKS AND SHARES.

Tuesday Evening.

The unexpected lowering of the Bank rate to 6 per cent. came as an agreeable shock to the Stock Exchange and its markets. At the same time there arose a fresh breath of hope for settlement of the coal dispute. The two factors, coming together, exercised a strengthening effect upon prices, although Stock Exchange men are apt to complain that they have been followed by very little increase in business. The fact is that the public are not in a speculative mood. The end of the half-year is close at hand, and the usual inclination to indulge in window-dressing will certainly not be less at the present time than it is in days when funds are more liquid, and there is more money about. The purely investment stocks are very firm, but apart from this, neither the Bank Rate nor the coal settlement has affected prices to any noticeable extent.

The London & Suburban Traction Co., Ltd., is inviting tenders for the redemption of a portion of the 5 per cent. "A" debenture stock under the sinking fund provisions contained in the trust deed. The price of the stock in the market is 66-70, but in a letter to the stockholders, the company pointed out that the price of the stock was 61 in the last transaction recorded, according to the official list of the London Stock Exchange. This particular transaction was effected in August, 1920, so it is not surprising that some exception should have been taken to the quotation of this price, at a time when the actual value is 66 upwards. Naturally the company wants to buy the stock as cheaply as possible, but, equally naturally, the debenture holders have the right to be told what is the current market price, as well as that which ruled last August. Therefore the announcement that the company is about to send out another letter to the stockholders, informing them of the higher prices which are quoted in the Stock Exchange official list, has given satisfaction. The secretary explains that the statement in his previous letter overlooked the recent markings of the price of the stock.

There are no changes to record in the list of home electricity shares. The market is very quiet, and settlement of the coal strike has had no effect so far. The tone of the market is described as being rather harder. Metropolitan Electric 7¼ per cent. debenture stock has further risen to 4¾ premium. The issue of North Metropolitan 7¼ per cent. debenture at 95, to which reference was made here two or three weeks ago, is on the point of emission. There was a keen demand for the underwriting, and it may be reasonable to expect a prompt subscription of the stock.

General Electric new debenture has been down to 4 discount, but rallied to 3¾ discount. The company's 6½ per cent. preference shares are easier at 16s., and the ordinary drooped to 1 1/32. English Electric preference at 15s. are 6d. harder, and the manufacturing group as a whole is steady. Some of the armament shares improved on bear covering, induced by the forthcoming resumption of work in the coal mines. Vickers ordinary picked up to 13s. 6d., and the 5 per cent. tax free preference hardened to 13s. 9d. Armstrongs also are better. Babcock & Wilcox remain at 2¾.

Underground Electric Income Bonds at 82½ are a couple of points to the good: otherwise the Underground market is dull, with Districts and Metropolitans both ¼ down on the week. There is a steady demand for the incomes, which has extended also to the company's 4½ per cent. bonds, the price of which is quoted higher at 95 middle.

Cable stocks are a trifle easier, in spite of the fall to 6 per cent. in the Bank Rate. Eastern Telegraph, Eastern Extensions, Great Northerns and Indo-Europeans are all lower, the last-named shedding 5 points to 30. It may be that stock has come in from people who require money for business purposes at the end of the half-year, while the July demands of the tax-collector tend to force into the market a certain amount of the good-class securities. The West India & Panama Co. shows a loss in its report of £58,000 on the year. To meet heavy general expenses, coupled with loss of revenue, the company sold securities for £66,000, which had cost £96,500. The investments now stand at £12,900, as against £109,400 at the end of 1919. On this lugubrious showing, the ordinary shares have dropped to 7s. 6d., and both classes of preference are quoted at 50s. middle.

British Electric Traction at 35½ is quietly steady, the meeting having no influence upon the price. The 6 per cent. preference stock changed hands the other day at 59. Brush ordinary

shares are 17s. 6d., and the 5 per cent. prior lien stock remains at 80; it has not altered this year.

Marconi's have been down to 2⅛ before rallying to 2¼. Dividend estimates have been modified considerably since the prophets were gaily talking, last April, of 15 to 20 per cent. The wild state of Ireland has had something to do with the recent neglect of a market which, as a rule, offers peculiar fascination to operators in the sister isle.

Brazilian Tractions have lost a further 1½ points, owing to the movements in the exchange. It is said in the Stock Exchange market that the company is pursuing the policy of putting large sums into the "road," instead of attempting to remit funds at the present unfavourable rate of exchange. If this is correct, its good effect will be felt, of course, in the future. Mexicans keep their prices, and other foreign descriptions show no variations worth mentioning. The stocks influenced by the American rate of exchange are mostly lower on the week.

There was a lunch given on the Wednesday of this week to the Mayor of the City of Vancouver, who is in England on a visit just now, and who was asked to meet a number of London bankers, Stock Exchange men and others with interests in British Columbia. In the past, there have arisen occasions when those on this side who own stock in the British Columbia Electric Railway have not been able to see eye-to-eye with the local authorities. The lunch should have helped to clear the air on various minor points of uncertainty that might disturb a cordiality of relationship which both sides are sincerely anxious to maintain for their mutual advantage. The gathering itself was a purely informal affair, but it will doubtless create a personal touch which will serve to assist maintenance of better fellowship in the future.

## SHARE LIST OF ELECTRICAL COMPANIES.

| | Dividend 1919. | Dividend 1920. | Price June 28, 1921. | Rise or fall. | Yield. p.c. |
|---|---|---|---|---|---|
| **Home Electricity Companies.** | | | | | |
| Brompton Ordinary | 12 | 12 | 6 | — | £10 0 0 |
| Charing Cross Ordinary | 7 | 8 | 8¼ | — | 10 6 6 |
| do. do. 4½ Pref. | 4½ | 4½ | 8 | — | 7 10 6 |
| Chelsea | 4 | 6 | 8½ | — | 9 4 8 |
| City of London | 13 | 14 | 1⅞ | — | 11 16 0 |
| do. do. 6 per cent. Pref. | 6 | 6 | 17/- | — | 7 1 2 |
| County of London | 8 | 8 | 8½ | — | 9 17 0 |
| do. do. 6 per cent. Pref. | 6 | 6 | 8¼ | — | 7 7 8 |
| Kensington Ordinary | 7 | 9 | 4⅜ | — | 10 18 2 |
| London Electric | 2½ | 2½ | 1 | — | 7 10 0 |
| do. do. 6 per cent. Pref. | 6 | 6 | 2⅝ | — | 10 18 2 |
| Metropolitan | 6 | 7 | 8½ | — | 10 0 0 |
| do. 4½ per cent. Pref. | 4½ | 4½ | 2⅛ | — | 7 18 2 |
| St. James' and Pall Mall | 12 | 12 | 6 | — | 10 0 0 |
| South London | 6 | 7 | 2¼ | — | 9 2 10 |
| South Metropolitan Pref. | 7 | 7 | 15/9 | — | 8 17 10 |
| Westminster Ordinary | 10 | 10 | 5½ | — | 9 10 6 |
| **Telegraphs and Telephones.** | | | | | |
| Anglo-Am. Tel. Pref. | 6 | 6 | 83½ | — | 7 3 9 |
| do. Def. | 1½ | 1½ | 16½ | — ⅜ | 8 19 0 |
| Chile Telephone | 6 | 6 | 5 | — ¼ | 6 0 0 |
| Cuba Sub. Ord. | 7 | 7 | 7½ | — | 9 6 8 |
| Eastern Extension | 10 | 10 | 164 | — ½ | 6 1 3 |
| Eastern Tel. Ord. | 10 | 10 | 166½ | —1 | 6 0 1 |
| Globe Tel. and T. Ord. | 10 | 10 | 16⅝ | — | 6 0 4 |
| do. do. Pref. | 6 | 6 | 9½ | — | 6 9 9 |
| Great Northern Tel. | 22 | 24 | 25½ | — ⅜ | 8 11 6 |
| Indo-European | 10 | 10 | 80 | —5 | 8 6 8 |
| Marconi | 25 | — | 2¼ | — | — |
| Oriental Telephone Ord. | 12 | 12 | 2⅞ | — | *5 13 0 |
| United R. Plate Tel. | 8 | 8 | 5¾ | — | 6 13 4 |
| West India and Panama | Nil | Nil | ⅜ | — ¼ | Nil. |
| Western Telegraph | 10 | 10 | 1c½ | — | *6 0 4 |
| **Home Rails.** | | | | | |
| Central London Ord. Assented | 4 | 4 | 48½ | — | 8 15 10 |
| Metropolitan | 1½ | 1½ | 25¼ | — ½ | 5 17 8 |
| do. District | Nil | Nil | 18 | — ½ | Nil |
| Underground Electric Ordinary | Nil | Nil | 2¼ | — | Nil |
| do. do. "A" | Nil | Nil | 7/- | — | Nil |
| do. do. Income | 4 | 2 | 69½ | +2 | 2 8 4 |
| **Foreign Trams, &c.** | | | | | |
| Anglo-Arg. Trams, First Pref. | 5¼ | 12½ | 9⅜ | — | 10 0 0 |
| do. do. 2nd Pref. | Nil | 5¼ | 2⅜ | — | 9 11 4 |
| do. do. 5 % Deb. | 5 | 5 | 66¼ | — | 7 12 8 |
| Brazil Tractions | Nil | Nil | 31 | —1½ | Nil |
| British Columbia Elec. Ry. Pfcd. | 5 | 5 | 56 | — | 8 18 6 |
| do. do. Preferred | 5 | 5 | 65½ | — | *8 15 0 |
| do. do. Deferred | 3 | 3 | 51½ | — | *11 17 6 |
| do. do. Deb. | 4½ | 4½ | 69½ | — | 7 2 10 |
| Mexico Trams 5 per cent. Bonds | Nil | Nil | 22½ | — | Nil |
| do. 6 per cent. Bonds | Nil | Nil | 23½ | — | Nil |
| Mexican Light Common | Nil | Nil | 11½ | — | Nil |
| do. Pref. | Nil | Nil | 18½ | — | Nil |
| do. 1st Bonds | Nil | Nil | 70½ | — | Nil |
| **Manufacturing Companies.** | | | | | |
| Babcock & Wilcox | 15 | 16 | 2⅜ | — | 6 14 6 |
| British Aluminium Ord. | 10 | 10 | 15/9 | — | 12 14 0 |
| British Insulated Ord. | 15 | 10 | 1⅝ | — | 9 12 0 |
| Callenders | 15 | 15 | 1⅜ | — | 10 0 0 |
| " 6½ Pref. | 6½ | 6½ | 17/6 | — | 7 8 7 |
| Crompton Ord. | 10 | 10 | 16/3 | — | 12 6 |
| Edison-Swan | 10 | — | 11/8 | — | — |
| do. do. 5 per cent. Deb. | 5 | 5 | 70 | — | 7 2 10 |
| Electric Construction | 10 | 10 | 16/3 | — | 12 6 2 |
| English Electric | 8 | 8 | 12/- | — | 13 6 8 |
| Do. Pref. | 6 | 6 | 18/- | +6d. | 8 0 0 |
| Gen. Elec. Pref. | 6½ | 6½ | 14/- | —6d. | 8 2 6 |
| do. Ord. | 10 | 10 | 1 | — | *9 13 8 |
| Henley | 15 | 15 | 1⅜ | — | 10 18 2 |
| do. 4½ Pref. | 4½ | 4½ | 3½ | — | 6 18 6 |
| India-Rubber | 10 | — | ⅛ | — | — |
| Met.-Vickers Pref. | 8 | 8 | 1/2 | — | 8 16 10 |
| Siemens Ord. | 10 | 10 | 1 | — | *10 0 0 |
| Telegraph Con. | 20 | 20 | 20½ | — | *5 17 0 |

* Dividends paid free of Income Tax.

## MARKET QUOTATIONS.

**It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.**

### Tuesday, June 28th.

| CHEMICALS, &c. | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|
| a Acid, Oxalic per lb. | 9½d. | ½d. dec. |
| a Ammoniac Sal per ton | £75 | .. |
| a Ammonia, Muriate (large crystal) " | £85 | .. |
| a Bisulphide of Carbon " | .. | .. |
| c Borax " | £34 | .. |
| a Copper Sulphate " | £31 | £2 dec. |
| a Potash, Chlorate per lb. | 7d. | .. |
| a " Perchlorate " | 8d. | .. |
| a Shellac per cwt. | £17 | £3 10s. dec. |
| a Sulphur, Sublimed Flowers " | £18 | .. |
| a " Lump " | £16 | .. |
| a Soda, Chlorate per lb. | 4d. | 1d. dec. |
| a " Crystals per ton | £7 | .. |
| a Sodium Bichromate, casks per lb. | 7d. | 1½d. dec. |
| **METALS, &c.** | | |
| g Babbitt's Metal Ingots per ton | £95 to £300 | .. |
| c Brass (rolled metal 2" to 12" basis) per lb. | 11½d. | ½d. dec. |
| c " Tubes (solid drawn) " | 1/1½ to 1/2 | .. |
| c " Wire, basis " | 11½d. | ½d. dec. |
| c Copper Tubes (solid drawn) " | 1/9½ | .. |
| c " Bars (best selected) per ton | £112 | £4 dec. |
| c " Sheet " | £112 | £4 dec. |
| c " Rod " | £112 | £4 dec. |
| d " (Electrolytic) Bars " | £76 | £3 dec. |
| d " " Sheets " | £145 | .. |
| d " " Wire Rods " | £92 | £3 dec. |
| d " " H.C. Wire per lb. | 11 7/16d. | 1/16d. dec. |
| f Ebonite Rod " | 1/0 | .. |
| f " Sheet " | 3/- | .. |
| a German Silver Wire " | 2/0 | .. |
| h Gutta-percha, fine " | 14/- to 16/- | .. |
| h India-rubber, Para fine " | 10½d. | ½d. dec. |
| f Iron Pig (Cleveland Warrants) per ton | Nom. | .. |
| f " Wire, galv. No. 8, P.O. qual. " | £40 | .. |
| g Lead, English Pig per ton | £24 10s. | 25/- inc. |
| g Mercury per bot. | £10 15 to £11 | .. |
| e Mica (in original cases) small per lb. | 4d. to 4/- | .. |
| e " " " medium " | 5/- to 10/- | .. |
| e " " " large " | 12/6 to 25/- & up | .. |
| p Phosphor Bronze, plain castings " | 1/4 to 1/9 | .. |
| p " " rolled bars and rods " | 2/1 to 2/6 | .. |
| p " " rolled strip & sheet " | 2/3 to 2/7 | .. |
| d Silicium Bronze Wire per lb. | 1/4 | .. |
| r Steel Magnet, in bars " | 1/8 | .. |
| a Tin, Block (English) per ton | £166 nom. | .. |
| a " Wire, Nos. 1 to 16 per lb. | 4/- | .. |
| p White Anti-friction Metals per ton | £78 to £300 | .. |

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
a P. Ormiston & Sons.
p ———
r W. F. Dennis & Co.

**Birmingham District Power & Traction Co., Ltd.**—The general meeting was held on June 22nd, Mr. C. S. B. Hilton (chairman and managing director) presiding. The chairman said that there was a small falling off in net receipts of £866. The gross traffic receipts were about £12,000 more than in the previous year, but dividends and interest on investments had fallen by almost a corresponding figure. The business of the Shropshire Power Co. had been prejudically affected by industrial unrest, and the result of that company's operations for the year had therefore not come up to expectations. The Birmingham & Midland Motor Omnibus Co. had, however, steadily progressed, and had again paid the substantial dividend of 10 per cent. Power and running expenses showed an increase of £10,000, but repairs and maintenance had cost £9,000 less, while administration expenses had gone up from £9,775 to £14,354. The net result was that they had an available balance of £71,140 compared with £73,953 in 1919, and the directors recommended the payment of a dividend on the ordinary shares at the rate of 6 per cent.

**Germany.**—According to the "Frankfurter Zeitung" a limited company is about to be founded called the Eilvese, with its seat in Berlin and a capital of 14,250,000 marks. The big wireless station of Eilvese will be brought into this company by its owners, the Hochfrequenz Aktien Gesellschaft, who, with the Telefunken group, will form the ownership of the new company. The compensation for the transfer of the station is 10,000,000 marks. These arrangements place long-distance transmission in one hand, and render competition impossible. The position of the Hochfrequenz shareholders is now as follows: Their company is now only a "holding company," which possesses the 40 per cent. with 7 per cent. guaranteed minority share in the Eilvese Co.; the claims to the 40,000 Marconi shares; a remainder of their title in the Compagnie Universelle de Télégraphie sans Fil; and, lastly, claims in America on the Tuckerton, N.J., station, estimated before the war at 1,810,000 marks. There may also be patent rights and plans, but no manufacturing works.

# B.T.H. ELECTRIC SHUNTING LOCOMOTIVES.

The advantages and economies that result from the introduction of electric locomotives into shunting yards were amply proved some considerable time ago, and are well known to those interested in the subject. Nevertheless, progress in this country has been slow, not because of the lack of suitable material, but rather owing to a reluctance to part with a system with which all parties are familiar. Further, the actual costs of shunting operations were seldom kept separately and, in consequence, the possibilities of economy were not appreciated. However, the present high prices of fuel, materials, and labour have served to draw attention to every channel of expenditure and, as a result, the cost of railway goods-yard operations has been realised in many cases for the first time.

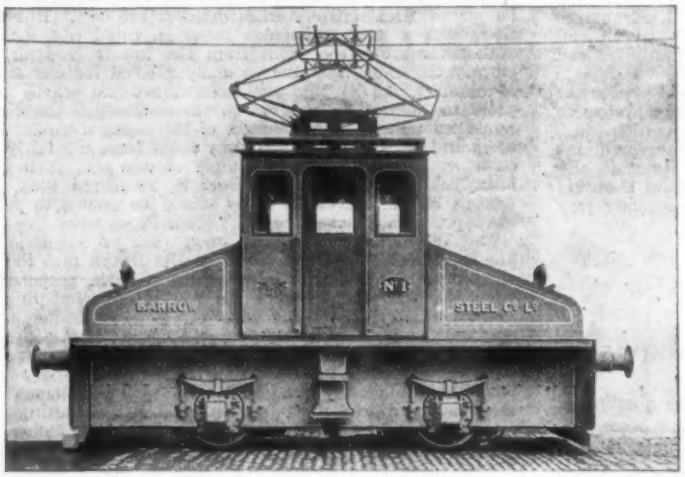


Fig. 1.—A 22-ton B.T.H. Electric Locomotive.

Apart from the question of fuel and maintenance charges, the electric locomotive has certain inherent advantages for this class of work. It is simple in operation; the actual machinery requires none of the driver's attention; it is instantly ready for work at all times; requires the minimum of attention outside working hours; and is not subject to the periodical lie-offs for boiler cleaning and repairs which are necessary with the steam locomotive. Add to this the fact that, due to its uniform torque, the electric locomotive is more powerful, weight for weight, than a steam locomotive, and can accelerate a load more quickly, and it becomes evident why in all electrification schemes it has been found possible to do more work with fewer locomotives. In recent experiments in this country it was shown that the average working speed of a steam shunting locomotive was approximately 2.5 miles per hour, whereas an electric locomotive would do the same work at an average speed of over 5 m.p.h., and that under by no means ideal conditions.

The steam shunting locomotive is notoriously inefficient. Considered purely on its merits as a steam engine and without reference to the work on which it is engaged, the fact that it is non-condensing tells heavily against it. Even under the best conditions of continuous full load it burns at least twice as much coal per horse-power-hour as is required for a turbo-generator of moderate size. It must be remembered, however, that a shunting locomotive usually work under very poor conditions. Even a hard worked shunting locomotive stands idle for approximately half its time, although it must always keep up steam pressure for full load. Further, the service is so intermittent that at each start, steam is admitted to cylinders which have had time to cool; also, in order to obtain a sustained tractive effort at low speed the valves must be set for a late cut off. It is not generally realised how very little useful work is done by a shunting locomotive, but it is doubtful if its average horse power output over the day exceeds 10 per cent. of its nominal rating.

In the case of the electric locomotive, it may be said that there are no stand-by losses. Power taken by any one locomotive will always be a small part of the total load on the generator; also, owing to the diversity of the load, the temporary overloads on any part of the system will not overload the generator as they will not all occur at the same time.

With regard to driving, the electric locomotive is very simple and easily handled. One man only is required per locomotive and, owing to the fact that there are no parts of the apparatus which require his attention while running, he can concentrate altogether on the control of the locomotive and its load. The locomotive is always ready in the shed first thing in the morning, and there are no additional labour charges for lighting up the furnace and raising steam. Shed cleaning charges will also be considerably lower, and it may be pointed out that the locomotive may be housed in any convenient shed without any danger of fire.

With regard to maintenance, the electric locomotive has proved itself definitely superior to the steam locomotive. Against boiler renewals and the upkeep of a complicated, if familiar, system of cranks and valves involving many bearings, rubbing surfaces, glands, and joints, we have to set the maintenance of two simple motors and gears, a controller, a current collector, and one or two switches; the renewable parts for these are small and inexpensive. The cost of maintenance of an electric locomotive has been found not to exceed one-third of that of a steam locomotive of equal capacity, and the prospective user of electric shunting locomotives need have no fears as to the reliability of the material.

The British Thomson-Houston Co., Ltd., of Rugby, supplied in 1906 to one of the home railway companies two shunting locomotives which weigh 56 tons each, and are handling the quayside traffic at Newcastle-on-Tyne. Each locomotive is fitted with four 90-h.p. motors, which can start a train weighing 160 tons on a grade of 1 in 27 and haul it on that grade at 10 miles per hour. They operate at 550 volts, the supply being collected from either a third rail or overhead conductor. Air brakes are fitted, which are supplied with air by a motor-driven compressor controlled by an automatic governor. Fig. 1 shows a 22-ton locomotive supplied to a large firm of steel makers in 1914. It is operated at 500 volts from an overhead conductor, and is fitted with two 85-h.p. motors. It is employed in hauling slag on a grade of 1 in 20, and is equipped with the same system of air brakes as the locomotive described above. A duplicate was supplied in 1916. Fig. 2 shows a smaller locomotive in use at a power station for hauling and shunting coal trucks. It weighs 10 tons and is fitted with two 25-h.p. motors.

Fig. 2.—A 10-ton Power Station Locomotive.

With regard to the system of distribution, there can be little doubt that d.c. power at 500/600 volts collected from an overhead conductor or trolley line is the best for a private shunting yard electrification system, and this voltage is usually obtainable without the necessity of laying down converting plant. Further, this pressure being a standard for tramway and railway work, there is a big selection of standard and well-tried apparatus from which to choose. The overhead system is the most generally suitable, although it may be necessary in certain circumstances to leave gaps in the line for the passage of cranes, &c. If the arrangement of the track is such that the gap would seriously interfere with the efficient working of the locomotive, it would be possible to arrange a short length of third rail at such points which would only be alive when the train was passing over it. Failing this, a small battery could be carried on the locomotive of sufficient capacity to carry it over the dead section.

An aspect of the matter upon which there is some misconception is the application of storage batteries to electric locomotives. Electric battery locomotives have shown very real economies in some specialised fields—for instance, in the case of mines where a trolley wire is sometimes inadmissible, or for handling contractors' railways where the run of the track is being altered from day to day. In these instances the locomotives have been extremely successful, and there is every reason to belive that at an early date they will completely supersde the costly system of haulage by man power or animals. They have also been used to a considerable extent in workshops for the same reason. In some cases, too, where the traffic is very light and the yard extensive, it may not be economical to install an overhead conductor line, but such conditions do not often occur in ordinary shunting practice, and in the majority of cases it is certain that the battery system cannot compete with a system drawing its power from an overhead line. Apart from the disadvantages which are inherent in storage batteries, enough has been said to show that in cases where it is impossible to fix an overhead or third rail, the battery locomotive may be able to show a considerable saving on haulage by steam locomotives, but that it cannot compete with an overhead conductor system as regards maintenance costs or convenience of operation.

In conclusion, it would appear that under the conditions obtaining to-day, when it is so necessary to prevent any waste of either labour or material, users of steam shunting locomotives would find it to their advantage to consider very carefully the conversion to electric working.

## ELECTRICAL CONDITIONS IN NORWAY.

SINCE referring in our issue of May 27th to the question of German competition in Norway, information has been published in Christiania with the object of throwing light on electrical conditions in that country. The information, which appeared in the Norwegian contemporary referred to on the previous occasion, consists of a statement made by Mr. Bruun, director of the Norwegian A.E.G., and a reply by the Industrial Union of Norway on behalf of the native manufacturing industry.

Mr. Bruun first recalled the fact that many Norwegian municipal authorities were compelled to suspend the work of establishing hydro-electric works in 1920, owing to the unusually high prices brought about by the war-time events. There was no question of proceeding with new works, because high prices excluded the possibility of such works becoming profitable unless the charges for electrical energy were to be fixed on a level which could not be reached by thousands of small consumers in town and country districts. Now when prices had fallen somewhat it must have a disconcerting effect for cries to be raised that foreign competition was too strong. In his opinion the fall in prices had not taken place to the extent which must occur if prices were to stand in proportion to what installations cost before the war. At present Norwegian prices were at least two and a half times greater than the former peace quotations, and they were not in proportion to the cost of the most important raw materials. If, therefore, the German prices lately had fallen to about double the pre-war prices, complaints could not be made that the Germans were dumping or that the installations were too cheap. The question must, therefore, involuntarily arise as to which factor was the more important in the economy of Norway—either the few electrical engineering works, of which some were financed during the favourable trade situation of the war, or the hundreds of thousands of consumers who have an interest in obtaining cheap power at the present time when labour is so costly. When cheap, electricity contributed towards the furtherance of Norwegian industry by rendering it able to compete, and not the least the export industry.

Dealing with the many newspaper articles recently published on the subject, Mr. Bruun stated that he was struck by the partiality and the extraordinary lack of knowledge displayed in them. People spoke of orders for electrical plant just as if the question concerned a sack of coffee or a bag of sugar. Yet everyone familiar with the orders knew that a large part of the machines must be supplied from abroad, because (1) the machinery was too large to be constructed by the Norwegian works, and (2) it was frequently the case that even if the plant could be built in the country it would be disproportionately dear owing to the fact that the works concerned were not laid out for such manufactures. In individual instances there was no Norwegian production of the plant ordered abroad.

M. Bruun proceeded to remark that he was in complete agreement with the idea that Norwegian industry should have reasonable protection in the case of orders for the State and the municipal authorities if the matter concerned something within their competency and their experience. The amount of the protection was a matter of opinion. Besides the prevailing import duties, the State had protected Norwegian industry up to 15 per cent., and had also stipulated that Norwegian plant should be protected for works built under State concessions, when equally good, by 10 per cent. In his opinion, these rates were proper if the protection was given only on goods in a tender which actually was of advantage to Norwegian industry. But it was quite obvious that if foreign firms were to place their technical knowledge and experience at their disposal in the submission of tenders, they must in fairness be able to demand to be previously informed of the amount of protection to be granted to native works. Otherwise foreign firms would naturally say that they would not incur the large expenses incidental to the preparation of all these schemes merely to exercise a controlling or regulating influence on Norwegian prices. The result would then be that all competition from abroad, both technical and commercial, would cease, and that would surely not be in the interests of the Norwegian community. Much was said of preventing unemployment and that, to that end, orders must only be placed with native works whatever the cost. But when there was a great difference in price, could not the local authorities order the plant from the lowest tenderer, and employ the amount of the economy effected for the starting of other works so that the difference would wholly be of profit to Norwegian labour? In this connection the director remarked that as a consequence of the changed conditions of the world since the war, Germany could become a fairly good customer of Norway as a consumer of iron ore, pyrites, carbide, fish, &c. It was, however, to be feared that under present circumstances Germany would be unable to pay for these products in any other way than by exports.

The Industrial Union of Norway (Norges Industrie Forbund), referring to the assertion of Mr. Bruun that the level of prices had not by far fallen so as to be in proportion to what machinery cost before the war, states that this is a matter which has nothing whatever to do with the present question, which exclusively concerns competition due to exchange conditions. Norwegian industry does not complain if Germany is able to deliver cheaper under otherwise equal monetary conditions. As to the statement that the question concerns the few electrical manufacturing works on the one hand and the consumers on the other, the Union remarks that this is not quite correct. German exchange dumping threatens to destroy the whole of the country's economy through increasing unemployment, diminished taxation revenue, and fall in the Norwegian exchange owing to larger imports and demoralisation as a consequence of unemployment. Concerning the charges made of inadequate productive capacity of native works, the Union states that the works are equipped so as to be able advantageously to turn out the largest types of machines in normal times. The protection of 10 per cent. granted to Norwegian industry was fixed by Parliament in 1894. But such protection is quite problematical when firms have to contend with an exchange like the German, which is about one-ninth part of the par value in relation to the Norwegian kroner; and there is, therefore, no question of competition when it takes place on such a difficult basis. The difference in exchange must first be eliminated before a protection of 10 or 15 per cent. can be of any practical importance. The Union dismisses as not being serious the suggestion that economies effected by local authorities in placing orders abroad should be utilised for providing employment; it states that the trained workmen can only be advantageously employed in their particular branches, and that it is doubtful whether the authorities would adopt such a proposal. As to the remark that Germany can only pay for imports by means of exports, the Union observes that this does not concern Norway, but that it can be taken for granted that Germany will not buy more than she absolutely needs from Norway just as the latter cannot import more than the absolute minimum.

## MAGNETOS FOR INTERNAL-COMBUSTION ENGINES.

### DISCUSSION AT MANCHESTER.

MR. E. A. WATSON'S paper, which was abstracted in our issues of May 6th and 13th, was discussed by members of the NORTH-WESTERN CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS on February 22nd, when Mr. J. Frith presided.

Prof. E. H. CRAPPER said he came from Sheffield, and the part it had played in the magneto business had been to supply magnet steel. The University of Sheffield was the only institution which demanded that its graduates for the degree of metallurgy should pass a written examination and a practical test in the magnetic properties of iron and steel. He was responsible for that particular section, and it had taken on in the engineering side rather than the metallurgical side. He soon found that there seemed to be a necessity to formulate some kind of analysis of the magnetic elements, and a good deal of work had been done. There were the working constants which had been referred to by Mr. Watson, and there were also constants relating to the nature of the material. Many of the constants they had to deal with, as regarded magnetic substances, were hyperbolic func-

tions of the magnetising force; that opened up a field of research which was bound to be productive of a good deal when they were endeavouring to see what was the actual nature of the material. The saturation value of the material was the most critical constant they had of it. The saturation value for B was an important constant, and if they were going to judge a material it must be taken up to a point sufficiently high to enable them to get the saturation value. He was quite convinced, as Sir Robert Hadfield and Prof. Hopkinson said in the paper that they read on the magnetic properties of iron and steel, that there were many cases in which if they once got the magnetic properties, they could actually tell the amount of carbon which was present in the steel. The better the steel the better the magnet, the greater the value of B, and the less would be the saturation value. With regard to cobalt steel, or Japanese steel, the first reference to the beneficial influence of cobalt on iron was by Prof. Weiss, of Zurich, who gave the results of his tests which were conducted at almost zero, and they were remarkable. Cobalt steel which was made in Sheffield during the last 12 months brought out very prominently the fact that if they wanted to know its real quality they must take the magnetising forces up to their highest value. With three curves (one corresponding to 400 units, another to 600 units, and finally one of 1,500), in the case of the 400 one, the magnetising force was about 175, and when H (by substitution) was 100 it gave, practically speaking, 200 units of magnetising force. The maximum values corresponding to the 1,500 units of H gave the value 714,000, whereas tungsten steel went approximately up to 300,000, which showed the influence of cobalt steel on the design of the magneto. It was also important to take the magnetising force up to the maximum value, because there was a difference of 214,000 between the points of 400 units and 1,500 units. Of the truth of the statement that "whatever changes take place in a magnet in consequence of external influences occur because the elastic limit of the material is such as to permit the movement of the molecules of the magnet to take place slowly or quickly as the case may be," he was perfectly convinced in his own mind, although he could not give a definite proof of it. There was no doubt about it, magnetically it was truly elastic, and he was convinced that for permanent magnet steel B could not be used logically, but intensity of magnetisation should be used. Not the permeability of a magnet steel, but its susceptibility, was the root of the matter. It was closely associated with elastic material from the mechanical point of view. The rate of change in the susceptibility was equal to E constant multiplied by the square of the susceptibility of that point, and E was a quantity associated with, or in some measure, the elastic limit of material. Prof. Crapper exhibited lantern slides, curves, formulæ, and tables illustrating the properties of various steels.

Mr. T. T. KAYSER explained that it was easy to get the wrong magnet to do the job quite satisfactorily if they did not trouble about the amount of steel they were using and the shape of it. But if they desired to have an economical design they must apply Mr. Watson's reasoning. The usual view had been that they were required a certain remanence in order to give the working flux, and a coercive force of about 60 or 70 to give permanence. Such a view was absolutely ridiculous; in the first place, coercive force did not give permanence. If two steels with the same remanence and the same coercive force were allowed to age, one would lose its properties very rapidly, and the other would keep them. What they really wanted to know was the maximum demagnetising force that steel would lose and the flux it would retain, and that was very clearly shown by the B H line. Really the remanence of steel was of little use to any designer; it was simply a property of a closed magnetic circuit, and so of very little use, because it could not be used with any external available energy. Referring to cobalt steel, he confirmed the figures given by Mr. Watson, and mentioned the figure 900,000. Working with such a steel he had obtained a figure as high as a million, but steels with such a high efficiency were not commercial possibilities at the present moment. But there were steels containing chromium cobalt giving about 700,000 which were already being commercially produced. He hoped that Sheffield University would not burden them with any more constants, they had got quite enough, and those interested in the development of magnet steel were not at all interested in the rate of change of susceptibility when they were making a permanent magnet.

Mr. G. A. CHEETHAM pointed out that finality in magneto design could not be attained until the problems relating to the function which magnetos had to perform were definitely solved. The electrical ignition of explosive mixtures must, therefore, be carried towards a conclusion before they could hope to see finality in magneto design. There was usually a tendency for factors of safety to be high when knowledge of the problem to be solved was incomplete. When war broke out the main problem was to fulfil a performance specification by all the machines completed with as little difficulty as possible, and without radical departure from fairly well-defined designs. That was quite a different problem from that which Mr. Watson and his colleagues now had before them, but the investigations undertaken in the solution of the first problem must have been invaluable when design itself began to evolve along scientific lines. A committee of the British Engineering Standards Association was at present sitting to standardise the commercial measurements of permanent magnets for all purposes. A further requirement in addition to the remanent induction and coercive force was essential for magneto work. This additional figure usually specified was the maximum product of B and H obtained on the design, which approximated to the maximum energy available. Experiments regarding the effect of increasing the air gap of a magneto showed that, in some cases, it was possible to obtain higher open-circuit voltage values across the primary winding of the magneto at a given speed with a larger air gap, provided the magneto was running under short-circuit conditions for a short period before the tests were caried out, although the voltage curves obtained before running under short-circuit conditions showed reduced values with increasing air gap in every case as expected; and it was felt that the very fine tolerance allowed in the air gap could be widened considerably without seriously reducing the ability of the machine to meet its requirements. The bearing in the magneto contact-breaker should be capable of operating satisfactorily without lubrication, and to obtain that object a fibre bush had been used for some time, but unless the material was well treated before it was put into position in the contact breaker considerable trouble was experienced due to seizing and packing.

Mr. J. D. PATON explained, with reference to that function of steel which practically had to be destroyed before they got the full zero, that Prof. Bragg's paper on molecular structure indicated an internal relation between the individual atoms, and a study of what took place in the Laval furnace explained the inherent property in any composite material, which was cited as existent in steel before the normal zero was defined. In steel which was a composite material there were numerous thermocouples, and there was a relationship between them which had to be destroyed. It was also a material fact that iron taken from the lowest normal temperature to the fluid state exhibited utility effects due to the different constituents which produced those internal currents. The reaction of those currents upon the iron was the destroying power of magnetism and, therefore, all magnetism disappeared at the red point.

Mr. SILLS was surprised to hear the remark made by Mr. Watson that "as long as you get a spark you get ignition." All ordinary magnetos should have a sort of fixed starting device, fitted so that one could start the engine with the absolute minimum amount of cam trouble.

The CHAIRMAN pointed out that they had heard a lot about the expense of cobalt-steel alloy, but in view of the reduction of the size of the magnet to get the same amount of work, how many pence would it amount to in the cost of a magnet? He felt sure it was not correct to say that "if there was a spark it was all right"; there were sparks and sparks. It was a very poor example of battery-coil firing that was represented in the paper. He had a car that had done 25,000 miles on battery firing, and he was rather glad he had not got a magneto. He had never had the slightest trouble.

Mr. E. A. WATSON, in reply, said that what an average man called a "fat" spark was very often simply a spark followed by a long flame, which was no good. He referred to the magnetic equation for steels, and the importance of saturation value, saying that there were three different quantities to represent the steel, and one could easily reconstruct the B H loop from them and calculate the flux of the machine for any definite conditions. Higher saturation value meant a better steel. The increased permeability was nothing like so wonderful as the increased coercive force; a 35 per cent. alloy of iron and cobalt had a saturation intensity about 25 per cent. higher than that of pure iron. The material had about from 3½ to 4 times the coercive force of the best tungsten steel, and about five or six times the coercive force of ordinary carbon steel. That was not pointed out by Weiss, whose paper only dealt with the carbon-free alloys, with the saturation density, and the permeability, not with the coercive force. In manufacturing cobalt steels, British manufacturers were taking the lead; Sheffield had produced many high-speed steels, and had now taken up the manufacture of those new magnet steels. The only thing that really mattered to the British manufacturer was the B H maximum of the steel; but at the same time one liked to know a bit more about what one was using than the bare facts of what it would do. Cobalt-chromium steels were certainly interesting, and they promised to give very good results with a smaller amount of cobalt. In view of the high price of cobalt that was very important; 35 per cent. cobalt, at its present price, was quite out of the question. The present price of cobalt steel per magnetic unit was certainly higher than the price of tungsten steel. On the other hand, it enabled other savings to be made. The machine could be made lighter and smaller. That did not mean less cost, but it saved a lot of useless material. In many cases the dimensions of the machine were controlled by the dimensions of the magnet, the latter determined the amount of aluminium, copper loss, and insulation, so one could cheapen the machine on that account as well as by reducing the magnet itself. It would not pay to substitute a cobalt-steel magnet for an ordinary tungsten-steel magnet; to make it a commercial proposition one had got to redesign the magneto. An advantage was that by using cobalt steel the magnet could be made straight. Regarding condenser breakdowns, the speaker had made tests of the transient voltage which sometimes reached a fairly high

figure; his own practice was 600 volts a.c., with a fairly high frequency. Very rarely did they get breakdowns for purely electrical reasons; usually breakdown troubles were to a large extent due to mechanical reasons—vibration or faults or cracks starting in the mica. A number of British firms were now using Bakelite in preference to fibre bushes. Into the concentricity of cams half a dozen elements entered, and no matter how fine limits were worked to, it was quite impossible to work on each part to limits sufficiently fine to ensure concentricity. Magneto makers did not like to admit it, but it was a common practice to do some sort of correcting operation on the complete machine to ensure concentricity. The problem of getting the cam concentric had been about the most serious mechanical problem which the magneto industry had had to face. The speaker had heard a good many nasty things said about American magnetos, and some of them were undoubtedly bad. They used very fine screws with very coarse threads without locking them, and, of course, the screws very soon fell out. They did all sorts of little foolish things like that which caused the magnetos to give trouble, and they got a bad name. It was not so much in the design itself—that was not bad—but simply because of the way the work was carried out.

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DISCUSSION AT BIRMINGHAM.

Mr. E. A. WATSON'S paper was also discussed by members of the SOUTH-MIDLAND CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS at Birmingham, on April 27th.

Mr. W. WILSON referred to the earlier practice of fitting magnetos with a plurality of narrow magnets and contrasted that with the present practice of fitting a single magnet. He had heard it explained that the reason for the use of several magnets was that, owing to the superficial nature of permanent magnetism, it was necessary to provide as large an area of free surfaces as possible, but he did not consider the explanation convincing, and asked whether a more satisfactory reason could be given.

Capt. CAVE-BROWN-CAVE spoke on the advantages of a gap in series between the h.p. winding of the magneto and the engine sparking plug, and referred to the practice, now common, of providing "jump-spark" distributors. He had heard of occasional trouble with those distributors owing to metal particles short-circuiting the h.p. leads, but his own experience with them was satisfactory. He also mentioned the possibilities of using influence machines for ignition purposes.

Mr. E. O. TURNER questioned the advisability of using the same leak resistance for utility tests at high and low speeds, and thought that at high speeds a higher leak resistance than that used at low speeds would be more consistent with engine working conditions. He commented unfavourably on Mr. Watson's curve showing the performance of a battery and coil ignition apparatus, and thought that the curve was not representative of the well-designed apparatus now obtainable. Further, he did not agree with Mr. Watson's advocacy of the jump spark distributor, but preferred the rubbing contact.

Dr. D. K. MORRIS referred to the important fact that, in determining from the demagnetisation curve the suitability of the permanent magnet for magneto work, the useful figure was not remanence, nor coercive force, nor their product, but the product of those values of B and H on the curve which gave the greatest value.

Prof. W. CRAMP said that the paper not only provided new and useful information for the benefit of makers and users of magnetos, but lifted the subject from the region of empirical guesswork to that of scientific design. After discussing certain points in the paper in detail, Prof. Cramp asked the author whether he had ever tried to measure mechanically the energy due to a given displacement of the armature. It seemed to him quite possible to accumulate energy in a moving mass, and so render the treatment of the subject independent of mental pictures.

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**Testing Electrical Appliances.** — Among the many interesting subjects dealt with in the recently-published report of the Merchandise Sales Bureau of the American N.E.L.A., is the testing of electrical appliances by a special division. These tests are to be carried out for manufacturers principally in order that they may have something to refer customers to when guaranteeing the reliability of their products. Among the tested appliances, &c., will be flexible cords, incandescent lamps, electric irons, washers, toasters, &c. Tests upon electric irons are already in progress. The main point which is receiving attention is the efficiency, *i.e.*, the ratio between the total wattage input and the useful work done. There will be tests for heating and cooking and observation of temperatures at different points as on the handle and at the point and centre of the sole plate. The effects of long-continued heating will be noted, and tests of mechanical or physical strength will also be carried out. The tests will be standardised so that they can be repeated on future occasions or elsewhere than the Association's laboratories.

## THERMAL CHARACTERISTICS OF ELECTRIC OVENS AND HOT PLATES.

DISCUSSION AT NEWCASTLE-ON-TYNE.

AT a meeting of the NORTH-EASTERN CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS at Newcastle-on-Tyne, on April 25th, Mr. J. R. Beard presiding, Dr. E. Griffiths and Mr. F. H. Schofield submitted their paper upon "Some Thermal Characteristics of Electric Ovens and Hot Plates," which was abstracted in our issue of February 18th, and a short discussion followed.

Mr. DOWNIE said the curve showing the influence of metallic contact between the hot plate and the disk was striking, and made the point quite clear. Regarding hot plates generally, he drew attention to the fact, that should not be overlooked, that their use required the provision of special pots and pans if economic use was to be obtained. He referred to the influence of surface oxidation of the copper disk and the point at which it reached maximum temperature, and asked whether a coating of black paint would improve the factor referred to. The condition they wanted for cooking and baking was different from what was wanted for boiling. For the former they required a very considerable heat, but for a comparatively short time, and from the point of view of economy the oven that reached its maximum heat quickly was much the best.

Prof. STROUD said it seemed to him there was too generally a tendency to copy older methods rather than to find new methods for themselves. He was glad to see the fact stressed about the sheeting of the oven and the condition of the vessel on the plate. The size of the utensil having regard to the size of the hot plate was of importance, and in some cases there must be considerable waste of heat from disregard of that fact. Why did they not get away from the gas-oven type of cooker? They needed to go into the question of design exhaustively; one in the form of a dome, with the heaters placed around it, had the advantage that there was no loss of heat due to the opening of the door, because the heat mounted upwards and could not escape. That type could be slung from the ceiling, and the articles to be cooked could be placed on a plate inside it. It was curious that people would look into the oven instead of ascertaining the heat otherwise.

Mr. PINKNEY thought the paper, excellent as it was, would be of service chiefly to those engaged in the manufacture of cookers. What was it they wanted the manufacturer to embody in the oven? Most of the modern ovens were pretty good, and he thought the chief weakness was the hot plate. What they required was a quick-heating hot plate—it must be efficient, reasonably quick heating, but above all they asked for reliability; that last point was an essential, and with respect to it they had much trouble and frequent demands for repairs. How far could the use of chrome steel, when it became more generally used, be utilised in the construction of utensils for electric cooking? The manufacture of suitable utensils should have their careful consideration, and manufacturers should do more towards supplying suitable articles. Another device deserving of attention was a heater for water boiling. There was much objection to the light type of oven owing to its lack of mechanical strength, and when that was remedied and they could get a cooker reasonably light, but possessing adequate strength for its intended purpose, they would have made considerable progress towards popularising the electric cooker.

Mr. WARD questioned somewhat the utility of the tests, and thought all-round tests would have been the best. He regretted that the authors had been more or less restricted in their inquiries. It seemed that the tests should have been of a more practical character. The facts that had been elicited were not of such a character that they could be used when speaking to prospective customers, or with those who already used electric cookers. The temperature curves for air in ovens and for the interior and exterior walls was excessive; the maximum of 15 minutes was too long, it seemed to him. Referring to Prof. Stroud's suggested dome oven, while with a door opening at the bottom there would be no loss of heat he thought it would be costly to maintain. They might devise a way of getting into it which would minimise any possible damage to the elements such as might follow from the frequent raising and lowering of the dome.

Mr. VIALL'S own experience was that the sheet metal lined ovens were more economical than those which followed the gas-stove design.

The CHAIRMAN raised the question of how far it would be possible to use vacuum blocks for insulation purposes between the linings of the oven.

Dr. GRIFFITHS, in reply, said they must have good thermal contact on the hot plate. Regarding Prof. Stroud's suggestion, an enormous amount of heat was wasted in the opening of the oven door to see the progress of the cooking, and when they sent in their report they suggested that the ovens should have a thermometer, but it was stated that those instruments would not last and, even if they did, cooks would not pay any heed to them. He was afraid the chairman's suggestion was not practicable.

# POWER TRANSMISSION AT 220,000 VOLTS.

## A Californian Scheme.*

Confidence in the attainment of a 220,000-volt transmission pressure has long been inspired by the successful operation of the American 150,000-volt lines, but the actual construction of such an installation was delayed by the engrossing activities of the war period. That power transmission at this pressure will nevertheless become an accomplished fact in the near future is proved by the active steps which the Southern California Edison Co. is now taking in that direction. In what follows the auto-transformers referred to (for raising the line pressure from 150,000 to 220,000 volts) should not be confused with those described later, which are to be used for linking up a new generating station through a single transformation from 11,000 to 220,000 volts.

For some years past the Southern California Edison Co. has been studying the power resources of the San Joaquin

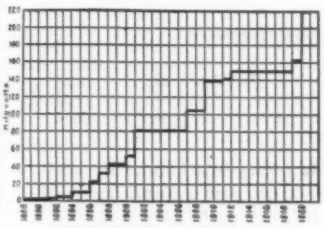

Fig. 1.—Increase of Maximum Transformer Pressure.

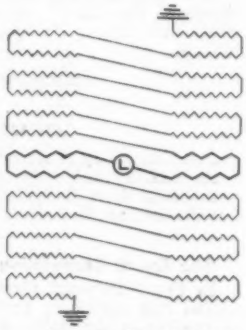

Fig. 2.—Diagram of Connections.

river and preparing to develop them as the demand for power grows. The studies revealed the fact that there was between 700,000 and 800,000 kW available, the larger part of which must be transmitted to Los Angeles, a distance of 240 miles. Since the capacity of the two 150,000-volt circuits now operating over that distance is 55,000 kW each, it was apparent that the possibilities of higher voltages must be studied to reduce the number of circuits and to obtain a correspondingly reduced cost per kW transmitted.

The rapid growth of the load indicates that additional plant must be placed in operation by 1923, at which time additional capacity will be needed, and raising the voltage of the present Big Creek 150,000-volt lines to 220,000 volts promises to be the quickest and cheapest method of obtaining the increased capacity. On account of the fact that, in case anything develops to make this plan impracticable, additional circuits must be built in time to coincide with the completion of the power plant, the company is proceeding as actively as possible with the necessary development work on the transmission line at the present time. The problem is, therefore, not the general one of how to build a 220,000-volt transmission system, but the more specific one of how to convert the existing 150,000-volt system into one for 220,000 volts.

The studies have now progressed to the point where a concrete plan of tests is ready to be carried out.

Considering first the line, the experiments of Peek, Ryan, and others indicated the use of shield rings, the effect of which is to cause a more uniform distribution of potential across the individual units of an insulator string. With such an arrangement the stresses on the individual units are considerably less at 220,000 than at 150,000 volts without the shield rings, as far as fundamental voltages are concerned. The occasional flashing over of insulators on this line has not yet been accounted for, and while perhaps it is not due to any one cause, the normal line potential probably has little to do with it.

The first step, therefore, will be to equip one circuit with guard rings throughout, and continue to operate it for a time at 150,000 volts, which will possibly throw some light on the reason for the flashovers. The next step will be to isolate the lower 40 miles of this circuit and operate it at 220,000 volts energised from some transformers on hand, but not carrying a commercial load, while the remainder continues to operate at 150,000 volts. There are strong probabilities that this may be all that it is necessary to do, but in case additional length of insulator strings is needed and additional shielding, the tower tops will be modified to provide the increased clearances necessary and further tests will be carried out.

Passing to the various stations on the line, the present stations are all completely equipped for two entering line positions and for double 150,000-volt bus connections inside. It is proposed to leave the inside of the stations exactly as they are now and to install in the outgoing lines banks of transformers for raising the voltage from 150,000 to 220,000. The transformers are to be star-connected on the h.p. side and delta on the low. The h.p. side will be arranged as an auto-transformer with 150,000-volt taps on the 220,000-volt winding, and the l.p. delta windings will be approximately 50 per cent. capacity and of the simplest possible design; no attempt will be made to utilise them for any other functions.

There will be one bank of these transformers in each line, installed between the line and the station, and each bank will be equal to the capacity of the station. The transformers will become a part of the line, and will be treated as such, and the full capacity of any station can be supplied over either line through the transformers connected to that line. No switching equipment of any kind will be used on either side of these transformers; the only instruments will be ammeters and the earth connection.

While the capacity of the transformers is spoken of as being equal to the capacity of the station, it must be remembered that their principal function is to act as auto-transformers, and they will be actually only 35 or 40 per cent. of the size of ordinary transformers of the same rating. Moreover, they can be designed for maximum efficiency at one-half load and a slight falling off permitted when one bank is carrying the whole load of a station. This plan has the advantages of low first cost, high electrical and financial efficiency, elimination of high-voltage oil switches of high capacity, and does not disturb or render obsolete any existing plant or investment.

The fact that the circular-coil concentric winding type of transformer is to be used in building the highest voltage power transformers in the world gives special significance to this form of construction. The line pressure of 220,000 volts, which has been tacitly agreed upon as being the approximate economic potential for the extensions and interconnections under consideration, constitutes a very abrupt step in the curve of maximum transformer voltages, as indicated by fig. 1. Nevertheless, there is every indication that its use will be as successful as that which characterised the operation of the 150,000-volt apparatus. The circular-coil design tends towards safety, and the elimination of the air space in the main containing tank is a noteworthy improvement, as is also the new oil-filled bushing.

Last summer the S.C. Edison Co. placed an order with the General Electric Co., U.S.A., for four water-cooled, 50-cycle, 8,333-kVA transformers which will step up the 11,000-volt pressure generated at the Big Creek No. 8 hydro-electric station to 220,000 volts. This transmission line is of interest in that it will be available as a permanent link in the

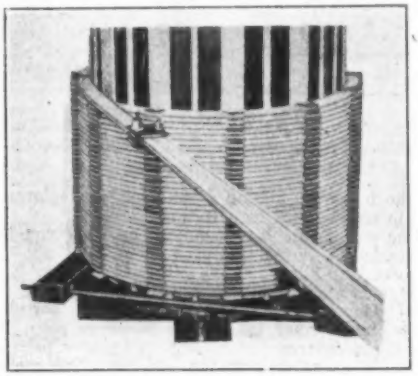

Fig. 3.—Helical l.p. Coil being Wound on Insulating Cylinder.

220,000-volt bus by which it is proposed to interconnect all the large natural powers throughout California.†

The transformers under discussion emphasise clearly the general advantages of the circular-coil design (viz., important simplification of the major insulation, superior mechanical strength against short-circuit forces, improved thermal characteristics, and the prevention of the concentration of electrostatic flux due to abnormal voltages), as well as the G.E. Co.'s novel arrangement of windings for Y-connected permanently-earthed units.

The schematic sketch, fig. 2, shows the connections on the h.p. side of a single-phase transformer, not the number of coils or their spacing; the slanting lines indicate series connections between the two core legs and the symmetrical sec-

* From the *General Electric Review*, May 19th, 1921.

† Paper by Sorensen, Cox and Armstrong, A.I.E.E., 1919.

tions in the body of the winding on either side of L may be paralleled to provide tap voltages. The h.p. line enters the "buffer coils" L at the centre of the stacks, or groups of h.p. windings, and progresses in either direction in two multiple circuits to earth, a method which avoids the necessity of insulating the winding from the core clamps except for the voltage of one coil, and eliminates the striking distances and creepage surfaces which would be necessary at these points for unearthed or delta-connected transformers. The insulation between turns and coils is graded so as to afford a very high safety factor at the line end where, in this design, abnormal stresses would reach a maximum. It is not necessary to repeat this extra insulation in the body of the windings as might be required with intermixed groups of high- and low-voltage coils.

The low-voltage windings consist of a single helical coil for each core leg (fig. 3), and are wound on ventilated insulating cylinders as illustrated, and are so proportioned with respect to diameter and thickness as to give ample supporting surface and rigidity. They are installed next to the core iron and inside of the high-voltage disk coils. Support is provided at the top and bottom by insulating blocks resting on the core frames. Both the high- and l.p. coils are of the one turn per layer type, built of round cornered rectangular copper and ventilated and supported throughout by "U" spacers.

The transformers are of the same general construction as the 10,000-kVA, 120,000-volt unit shown in fig. 4, but, unlike the latter, have no porcelain supports at the ends of the

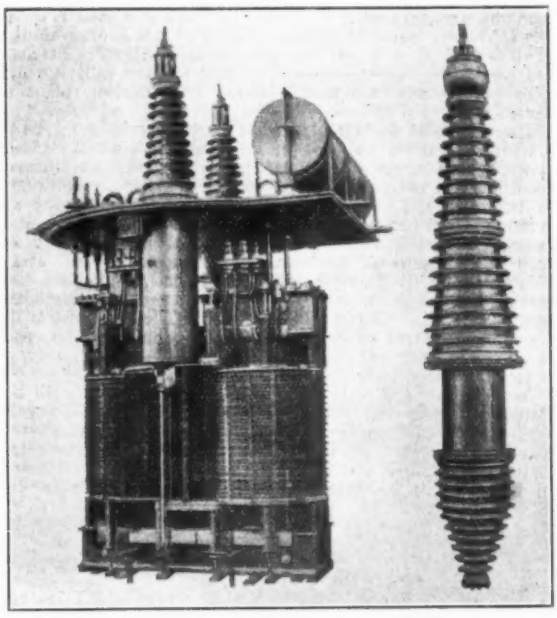

Fig. 4.—A 10,000-kVA 120,000-volt Transformer.

Fig. 5.—An Oil-filled 250,000-volt Bushing.

stacks, the h.p. coils resting directly on steel plates anchored to the top and bottom core frames.

The line end of the h.p. winding, coming from the centre of the stacks as shown in fig. 2, is brought out through a new standard oil-filled 250,000-volt bushing, fig. 5, which is interchangeable between the transformers and h.p. oil circuit breakers. The external shell consists of two porcelain pieces above the transformer cover, one porcelain piece below the cover, and an intermediate metal cylinder which is flanged at the upper end to support the bushing. This metal portion always extends below the transformer oil level to avoid any possibility of corona in transformers having an air space between the oil level and cover. A metal tube extends from top to bottom through the centre of the bushing, and the intervening space between this tube and the porcelain shell is filled with "transil" oil and concentric cylindrical insulating barriers. The glass chamber at the top provides space for expansion of the oil and indicates its level. The joints between the shell sections are made with treated cork gaskets compressed locally by numerous bolts engaging metal clamping rings. The central tube serves as the conductor when used in a breaker and as a conduit for a cable conductor in a transformer.

The bushing has a dry flashover voltage of 660,000. The lightning flashover is estimated at more than twice the normal frequency figure and is equal for wet or dry conditions. In the event of any high impressed voltages the bushing will not puncture, but will arc from the terminal to earth without damage, and an essentially uniform surface distribution of potential is obtained, thus preventing corona on the surfaces.

The containing tank is of the "oil conservator" type, having a separate chamber for oil expansion, and involving the elimination of the usual air space above the oil in the main tank and the isolation of the hot oil and transformer insulation from the surrounding air. The main tank is always completely filled with oil, and pressure is prevented by opening the auxiliary tank to the outside air through a "breathing" device. Any accumulation of moisture in the auxiliary tank due to condensation is caught in a sump and drawn off through a pet-cock at the bottom. This construction eliminates "breathing" in the main tank and keeps the oil absolutely dry; avoids explosions due to a possible mixture of air and gas formed from hot or decomposed oil; protects the oil from "sludging," and preserves the transformer insulation to a remarkable extent.

The total weight of the transformer is 50 tons, including oil. The height from rail to top of bushing is 24 ft., and the diameter is 10½ ft.

A current transformer is mounted on the cover and connected into the neutral circuit before the tank is earthed, and the current transformers of three units (one three-phase bank) have their secondaries connected in parallel so that any unbalanced current (earth current) can be measured.

It is an interesting fact that the manufacturers had actually designed the 220-kV transformers long before any definite plans had been made by power interests for operation at this voltage.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### The Dover Corporation Electricity Works and its Staff.

In the "Personal Column" of your current issue, it is stated that the Dover Town Council has decided to give notice to practically the whole of the technical staff at the electricity works, and to offer them the option of re-engaging at a much lower salary for each appointment.

This move must be resisted, not only with firmness, but with promptitude. It is to be hoped that as far as the E.P.E.A. is concerned, the official order will be that no official who is a member of the E.P.E.A. shall continue for a single week in the employ of the Dover Council at the reduced rate of pay.

There is no time for arguing and shilly-shallying about the matter. Either these notices are withdrawn or our members cease to serve the Dover Council.

Any other policy means that Councils up and down the country will be only too glad to follow suit, and to back Dover Council up, if they think there is any chance of forcing these terms on their staffs.

It is a matter of vital interest to every member; and if necessary we must be prepared to pay a high levy in order to support those of our members who may be temporarily out of a berth.

The only policy for the E.P.E.A. to take is to shut the place down. Any half measures, any vacillating or compromising, will mean a wholesale slump in salaries from Dover to Aberdeen.

The latter place has been humoured a good deal. The logical result is seen in the present "try on" at Dover. This must be stopped; and stopped with a jerk.

It is to be hoped that mains men and shift men (I happen to belong to the latter) will now drop their public quarrelling, and will back the E.P.E.A. through what promises to be a most serious crisis.

Our point is that we were so miserably underpaid in 1914, that any salary list based on double the 1914 rate would leave us far below the wretched economic level of that year.

The senior shift job at Dover is quoted as being paid at the princely salary of £100 a year in 1914. If the berth had been paid at a reasonable rate, the *lowest* salary would then have been £160, rising to £200 by £10 a year.

The salary acceptable to-day should, therefore, be at least £320. That post now carries £293, and it is proposed to reduce it to £236.

Let our National Executive handle this matter firmly and promptly, and it will have every member in the Association behind it.

P. W.

*June 27th*, 1921.

### Electric Light Wiring Systems.

I have always viewed the intelligence of my fellow followers of the art with some considerable feelings of pride, but your correspondent's remarks on the relative merits of wiring systems have given rise to some misgivings.

Surely it is only a matter of common sense that a wiring system which, under certain conditions may be excellent, will be, under other conditions, out of the question.

Because one thinks personally that screwed tube makes the best wiring job, it does not necessarily rule out of court all other systems, when under consideration of installation

costs or the interference with decorations C.T.S., Henley's, or some such system would be the one to adopt.

I agree that Mr. Alldread's trouble with C.T.S. cable was probably due to careless handling and sharp bends.

I am amused by the remark of Mr. J. M. Ward that cementing the ends of the underground conduit gave more trouble from condensation. I should have thought that the remedy was to provide an outlet for the water, and not to seal the trouble up.

Lead sheathing is likely to give trouble under certain conditions, unless the sheathing is itself protected, *e.g.*, by compounding.

The writer remembers a lead telephone cable fixed in a brick wall losing practically all of its sheathing in six months owing to salt being present in the sand used by the builders.

I should like to deprecate the practice of some conduit manufacturers in effectually enamelling the female threaded portion of conduit fittings; this is liable to occasion bad electrical continuity. The writer remembers instances of trouble in this direction.

In conclusion, whatever the system adopted, however well engineered the installation, the degree of skill of the wireman employed must be the deciding factor in a perfect installation.

**H. Verrall.**

*June 27th*, 1921.

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With reference to Mr. J. M. Ward's letter in this week's REVIEW, I note from his remarks he has had considerable experience in electrical work, and I am astonished at his attitude towards screwed conduit.

He refers to a church building, where cables are run underground in screwed conduit covered with cement. Was it necessary to cover the conduit with cement? In buildings of this size, a trench is usually provided for this, whereby access can always be obtained. On the other hand, and in this particular instance, where the conduit was covered with cement, may I ask Mr. Ward if he is assured that condensation did occur? It is possible that the job may not have been watertight in the first instance. Much depends on what class of conduit was used. It must be borne in mind that various qualities are on the market, and in the electrical trade as well as other trades, inferior material is prevalent. Nothing gives more satisfaction than a well-laid-out installation of steel conduit, and I am confident that this particular difficulty could have been avoided in the first instance had a little more thought been given.

I am in constant touch with consulting engineers, architects, and electrical contractors, and with due respect to the other systems of lighting, they highly recommend the screwed conduit system, and when possible insist on this system being employed.

**J. P. Gibb.**

Dundee.
*June 27th*, 1921.

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### The Cost of Living in Spain.

If your correspondent "Rover" is going out alone to a Spanish village he will probably have no alternative but to put up at the local "fonda" or inn, when board and lodgings will cost him up to 12 pesetas (approximately 9s. at present exchange) a day. Accommodation is about on a par with that provided in remote English villages. The food is good and plentiful, but it generally takes an Englishman a week or two to get used to it, owing to the prevalence of olive oil and garlic. The sanitary arrangements are crude.

If two or three Englishmen are working together, the best way for them is to rent a small house and furnish it with a minimum of cheap furniture, but taking care to provide adequate kitchen utensils and cutlery. Domestic help can be hired for 40 or 50 pesetas a month, and a servant will do all the necessary buying of food, &c. She will doubtless receive a commission on her buyings from the shop-keepers, but will nevertheless buy cheaper than an Englishman can. Expenses by this method work out about the same as inn charges, but there is the advantage that fare more nearly approximating English food can be thus obtained. Also, expenses are more under control, and if one of the Englishmen is put in charge of the management of the house, the total cost of living need not be more than £8 or £9 per head per month, including wine.

"Rover" will find the Spaniards of all classes very sociable. They will be pleased to give him all kinds of assistance, and if he has a knowledge of the language (no matter how slight) he should find his stay in Spain a pleasant one.

**E. Scott Rivett.**

London.
*June 25th*, 1921.

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### The London Electricity Inquiry.

I should like to call your attention to the last paragraph in your Editorial of last week upon the above subject, which I think is not only misleading, but in part inaccurate.

The main reason that the railways can supply themselves with electrical energy at a cheaper rate than they could obtain it at from a Joint Electricity Authority is because the load factor of the railways is very much higher than that of the Joint Authority.

No doubt the sinking fund is a secondary and minor factor, and would depend, for its effect, upon the amount set aside by the railways for depreciation.

When you state, however, or rather infer, that generally private enterprise can compete favourably with municipal supply, you are making a statement which is entirely opposed to the evidence shown in all the published comparative statements of costs and prices charged, which is overwhelmingly in favour of the municipal undertakings.

**Municipal.**

*June 25th*, 1921.

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### Abnormal Meter Records.

May I bring to your notice the peculiar behaviour of 20 meters installed for lighting installations in this city? There was a sudden rise in consumption during the month of March out of all proportion to the size of the installations connected; in April all these meters showed their normal readings.

It may further be noted that the meters, which are of the Ferranti a.c., single-phase, 230-volt, 50-cycle type, are not all connected to the same distributor or transformer. Figures are enclosed showing the readings of eight of these for four months of this year and the corresponding months of last year.

| UNITS CONSUMED, 1920. | | | | | UNITS CONSUMED, 1921. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Jan. | Feb. | Mar. | Apr. | Total. | Jan. | Feb. | Mar. | Apr. | Total. |
| 15 | 15 | 14 | 31 | 75 | 35 | 18 | 123 | 21 | 197 |
| 11 | 6 | 11 | 8 | 36 | 5 | 8 | 98 | 27 | 138 |
| 53 | 42 | 54 | 41 | 190 | 71 | 35 | 115 | 44 | 265 |
| 36 | 29 | 37 | 18 | 120 | 12 | 13 | 105 | 27 | 157 |
| 17 | 14 | 11 | 40 | 82 | 8 | 10 | 202 | 20 | 240 |
| 17 | 22 | 7 | 20 | 66 | 30 | 28 | 228 | 13 | 299 |
| 23 | 20 | 18 | 18 | 79 | 8 | 2 | 93 | 8 | 111 |
| — | — | — | — | — | 15 | 14 | 139 | 27 | 195 |

I shall be obliged if you can give me any reason for the above.

**R. Forrest Preston,**
*Engineer and Manager.*

Electricity Works, Ahmedabad.
*May 28th*, 1921.

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### Armature Core Bands.

I would be pleased if you could give me your opinion, or any of your readers theirs, on the following, which I think would be of interest to a great number of subscribers to the REVIEW. During the course of my business (electrical) we have come across an armature which is rated at 1,750 r.p.m., this is wound with copper strip of size .5×.048; after winding it is banded on the core with No. 20 steel banding wire, ¼ in. wide, the outer bands with No. 18 steel banding wire; after running some time the core bands began, to spread, and ultimately break away. Double layer bands were then used, and after running about four months, burst; the outer bands (on the winding) still remain and seem quite as good as when put on, and do not show any signs of breaking away. As I have never, in my 15 years' experience, come across anything like this before, I trust that you will endeavour to give me the benefit of your readers' opinions, which will be greatly appreciated by

**Armature.**

*June 21st*, 1921.

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### Standard Brush-holders.

Some 12 months or so ago I was shown a small brush-holder which I was informed was likely to become the standard, or one of the standards, for use on d.c. machines. Although I have made several inquiries recently I cannot find out anything further with regard to the matter, and shall be glad if you can give me any information.

The whole question of brush gear and brushes sadly needs overhauling, and, personally, whenever I hear of a designer having brought out a new type of brush-holder—an item of news I occasionally come across—I must admit I feel rather inclined to slay him, as I am quite certain there are enough types of holder on the market already to satisfy any reasonable person's requirements.

Any information which you can give on this matter will, I am sure, be appreciated by a good many engineers.

**Worried.**

*June 21st*, 1921.

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### The Grading of Mains Engineers.

Like "Another Meter Engineer," the writer is very pleased to see that at last someone has dared to "break the ice," so to speak, regarding the status of the man in charge of the meters.

It is, indeed, a lamentable fact that amongst a great number of supply authorities the meter superintendent, meter tester, or whatsoever name they chose to give him, is looked upon as an individual who is expected to be able to satisfy any sceptical consumer as to the accuracy of his or her meter (not an easy job by any means), and to be at the beck and call of all and sundry on the undertaking, from the managing engineer to the office boy.

What is the use of the power station technical staff carefully compiling the cost of coal per unit sent out, ounces of

steam per unit generated, &c., if the man in charge of the meters is not conscientiously carrying out his duties? Is it not akin to the old saying of straining out gnats and swallowing camels?

There can be no doubt whatever that on the meter man depends the revenue of the concern; his responsibility in this respect should, therefore, be recognised to the full, and every consideration and facility should be given him to carry out his work efficiently. He should have at least a respectable test room and reliable instruments, which should remain *his* as long as he is employed by the authority concerned, and not be used as a workshop for the wiremen, nor should his instruments be placed at the disposal of apprentices, &c. Yet how often does one find that the meter department consists of some out-of-the-way corner of the power house, badly lit, and filthy dirty, and what instruments he is fortunate (or unfortunate) enough to possess are badly in need of repair. A few pounds laid out on the meter department will more than repay themselves in a very short time if the right man is there to carry out the work, and if the right man *is* there, surely he should be placed on an equal footing in every way with the mains engineer, with whom more often than not he has to work in co-ordination.

The writer hopes to see more correspondence on this subject, and trusts that the day is not far distant when the long-forgotten meter engineer will receive his dues in more ways than one.

**Rev. Counter.**

*June 27th*, 1921.

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In your issue of June 17th, one of your correspondents asks if any reader knows of any grading for the meter engineer. I know of a 4,000-kW station where the meter engineer had a pre-war weekly salary of 35s. This gentleman is now in receipt of £354 per annum, being graded on the salary of the mains superintendent, according to the E.P.E.A. Schedule. It is clear, therefore, that he must be in grade 7. In the same station the charge engineers were getting a pre-war salary of 50s. per week—they now get £295 per annum. That does not look, on the face of it, as though the meter engineer had a lot of grounds for grousing; whereas the charge engineer (one of whose spare-time duties used to be the calibrating and testing of meters) is in grade 8; one below that of the meter engineer. This is one of the many reasons why the charge engineer is fed up with the E.P.E.A.

**It Won't Do.**

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Perhaps you will allow me to correct a misconstruction which "C. S. W." has placed upon certain statements in my recent letter wherein I urged the desirability of a leavening of shift men being elected to the E.P.E.A. committees. To argue from this that I advocated the packing of these committees with shift engineers merely because they are shift engineers, and without regard for their fitness or ability, is absurd, although the absurdity of the suggestion that brains are the exclusive prerogative of day men is no less obvious.

It is a little amusing to note "C. S. W.'s" estimate of the calibre of the genus shift engineer. He is an unskilful or hot-headed operator, to whose tender mercies the Association is not to be lightly handed over. This startling truth presages a serious state of affairs when the present supply of day men begins to give out and has to be replenished from the ranks of the lower grades. Will not the electricity supply industry then be in a parlous plight indeed?

Without disputing for a moment the excellence of the advice to select the best man for the job and vote for him, I still hold that psychology should be considered, and it is only common sense to believe that those who are bearing the heat and burden of the day on shift duties must necessarily have a more vivid sense of the problems peculiar to their grades than those who are fortunate enough—not invariably nor essentially *clever* enough—to have become emancipated. It is for this reason chiefly that I consider a proportion of shift men on the various committees highly desirable.

I fully concur in the opinion of "C. S. W." that the Association has been most skilfully steered so far through troublous times. All honour to the men who have succeeded so well in a difficult task. With regard to the Negotiating Committee, of course it is easy for those with a grievance to seize upon the first scapegoat that presents itself, and possibly the severe criticism to which this body has been subjected is undeserved. I have little doubt the members did their best in the interests of all, according to the faith that was in them. I would not dream of doubting their integrity, only I feel it is unfortunate that I, along with so large a number of members of the E.P.E.A., should have occasion to regret the necessity of signing myself

**Grade 8.**

*June 27th*, 1921.

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**Converting 50-cycle Alternating to 1,500-V Direct Current.**

I am obliged to "M. A. R." for his criticism, and admit that for the moment, I had forgotten the mercury arc rectifier.

I am *not* an expert in electric traction, but in the case under discussion, I should be inclined to install mercury rectifiers in most of the sub-stations; but I would install, say, two motor converters somewhere on the system.

My reason would be that the mercury rectifier is irreversible and as regenerative control would probably be used, it is conceivable that the regenerated power of the system might occasionally exceed the load for a few minutes. Under those conditions, if the supply were wholly through rectifiers, the line volts might become excessive, and the only regenerative brake then available to the locomotives would be that provided by a resistance which, I imagine, would be required to maintain the arcs under such circumstances. Of course, I admit that the occurrence of the above condition would be more frequent in the case of the electrification of a comparatively short mountain section such as has been done in the United States, than in the case of a whole system like the S.E. & C.R.

The title (not my choice) of "M.A.R.'s" letter and my previous one is somewhat unfortunate, as the case was not one of the conversion of 1,500 V a.c., but of, I imagine, about 6,000 V a.c.

Up to about 12,000 V a.c. the motor converter, of course, needs no transformer.

**K. W.**

*June 27th*, 1921.

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**Marine Electrician.**

Could you give me any information as to how I could get into the mercantile marine as an electrician, or where I could get such information?

**E. R. M.**

[The usual course, we believe, is to apply direct to shipping companies. Possibly our readers will help our correspondent. —EDS. ELEC. REV.]

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**Technical Books.**

I should be very grateful to any of your readers who could express an opinion on a technical work which is in my possession, namely, the "Cyclopedia of Applied Electricity," published by the American Technical Society (1921).

I am only a young engineer, and would like to know from more experienced authorities if this work can be relied on for general information regarding electrical engineering in this country.

I should also be glad to hear of a similar complete and up-to-date publication dealing with practical electrical engineering as applied in England.

**L. W. C.**

*June 26th*, 1921.

["Modern Electrical Engineering" (1919), edited by Prof. M. Maclean, is the most encyclopædic British work on this subject.—EDS. ELEC. REV.]

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**Diesel Engine Repaired by Welding.** — Much has recently been written on the subject of electric welding, but the following brief description of the repair of a 600-b.h.p. Diesel engine carried out by this means may be of interest to engineers. The repair was effected without dismounting the engine, for the Charing Cross, West End & City Electricity Supply Co., Ltd., at the St. Martin's Lane station.

The base of the main A column of the engine was cracked as the result of an accident, the crack on one column extending right round the front half and about two-thirds round the back half of the column through metal varying from 2½ to 3½ in. thick, whilst the other column was cracked at the ends inside and outside. Work was commenced by chipping out the metal surrounding the crack from both sides of the casting, to form a "vee" for the reception of the weld metal, 2½ in. wide and varying in depth with the thickness of the casting. The welding, which was carried out with "A. W. P." electrodes, was commenced as soon as one-half of the crack had been chipped out and other operations necessary on this class of work were completed.

It may here be mentioned that welding cast iron is at all times a difficult matter, and that the difficulties are increased where, as in this case, the casting cannot be preheated. The Union Electric Welding Co., Ltd., which was responsible for the work, is able, however, as has been pointed out in our columns by Major J. Caldwell, to weld this metal with good results owing to the fact that its operators can reduce to a minimum the injurious strains set up in the metal due to the contraction of the casting on cooling.

Welding was proceeded with in sections of about 9 in., great care being taken that the added metal was thoroughly united with the original metal. Approximately 700 ft. of "A.W.P." electrodes were used, representing 50 lb. of added metal, and as the electricity for welding was supplied by the Charing Cross Co., the only equipment required consisted of a portable resistance, electrode holders, and cables. A portable air-compressing plant was used to serve the pneumatic tools used for the chipping operation.

Great credit is due to the engineer of the Charing Cross Co. for having this important repair carried out by means of electric welding, thereby saving the company a considerable amount of time and money. The engine was run on load within four weeks from the commencement of the repair.

# NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

*Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.*

### The "Garage" Converter.

The problem of charging the smaller sizes of accumulator from an a.c. circuit may be easily solved by means of the "Garage" current converter (fig. 1) made by the OVERSEAS ENGINEERING CO., LTD., 163-165, Great Portland Street, W. 1. This device consists of a small auto-transformer which reduces the pressure of an ordinary lighting circuit to the lower voltage necessary for charging accumulators. Combined with the

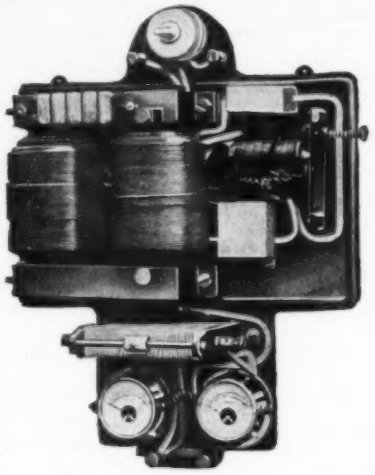

FIG. 1.—THE "GARAGE" CURRENT CONVERTER.

transformer is an ordinary vibrator which ensures that the current passes in one direction only. As the current taken by the converter is small, the appliance may be connected to any wall plug or lamp socket on a circuit of the correct voltage and frequency. The usual sizes range from 4 to 12 volts for 110- or 200/240-volt circuits; they are supplied for any frequency from 25 to 100 cycles.

### A Flexible Insulating Coupling.

Among the exhibits at the recent Rubber Exhibition at the Agricultural Hall was a patent flexible coupling, shown by its makers, MESSRS. R. FAUSET GILLESPIE & CO., 42, Frederick Street, Edinburgh. This coupling (fig. 4) consists of two

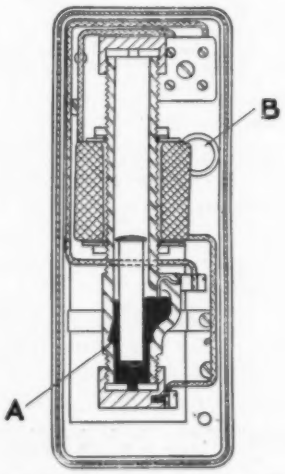


FIG. 2.—IMPROVED "UTILITY" CURRENT LIMITER.

castings only with a number of rubber buffers which are very durable. As the coupling is virtually a universal joint (the maximum degree of angularity being fixed by the clearance allowed between the two parts) all inaccuracies of alignment are neutralised. The coupling can be driven in either direction, and either of the two halves can be keyed to the driving shaft. The contact area between the iron and the rubber is automatically adjusted to suit the load.

### The "Utility" Current Limiter.

The "Utility" current limiter was described in these columns some months ago. The makers, ELECTRICAL UTILITIES, LTD., 1-3, Shelgate Road, S.W. 11, have sent us particulars of an improvement (patent applied for) introduced into this instrument.

As in other types, the "Utility" current limiter provides for a flicker when excessive current is used, but a certain amount of heat can be obtained even with this flickering current. Hence a neat little improvement in the ebonite mercury tube has been introduced. From the illustration (fig. 2) it will be seen that a groove A is provided in the lower part of the tube. This groove does not affect the working of the limiter in normal operation or even when there is a small overload, as the plunger does not rise high enough. If,

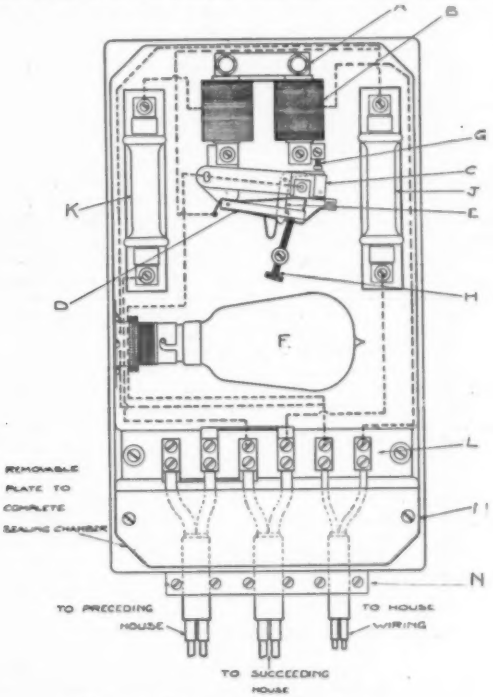


FIG. 3.—EDISWAN CURRENT LIMITER.

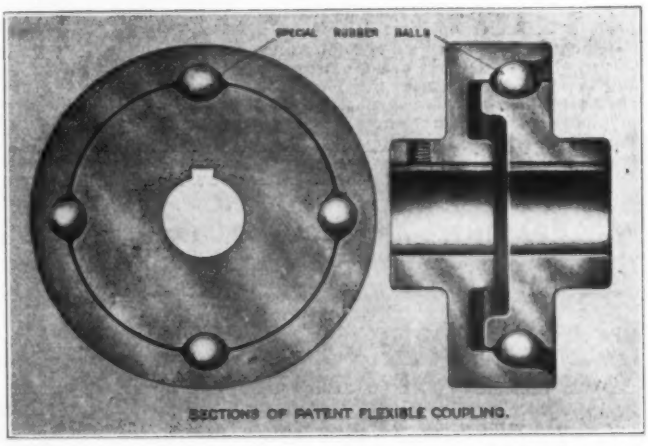


FIG. 4.—A FLEXIBLE INSULATING COUPLING.

however, a consumer who has, say, a 1-amp. limiter in his house, endeavours to use a flat iron or other heating device, using, say, 1.5 amps. the plunger in its flickering operation will rise sufficiently for the bottom flange to slip into the groove and rest on the bottom face. There is no uncertainty in this action, as the plunger, although floating in mercury, is in unstable equilibrium, and tends to assume a tilting position in the tube, thus forcing one point of the bottom flange into the groove. With the plunger in this position the circuit is definitely broken, and will remain so until the limiter case is tapped. A comparatively slight tap will release the plunger, but if the excessive load continues the plunger again rises and immediately drops into the groove again. A further

modification to suit the requirements of certain engineers is the provision of a bushed hole B in the base of the instrument, so that the wires from the external circuit can be led into the instrument without being visible. In this case there is, of course, no opening in the cover.

### A New Current Limiter.

The new form of current-limiting device produced by the Edison Swan Electric Co., Ltd., of Ponders End, Middlesex, which is claimed to be entirely novel, embodies a special lamp resistance, and when the predetermined amount of energy is exceeded the limiter operates and switches the lamp resistance in series with the load, thus dimming all the lamps on circuit. This does not annoy the consumer nearly so much as the flickering, or as total extinction, particularly as the switching off of the last lamp, even if it is of only 20 watts capacity, will immediately restore the rest of the lamps to full brilliancy. A further advantage to be noted is that if an electric iron be switched on, or even a 1-kW radiator, the limiter will simply operate in the usual way and no more current can pass than the lamp resistance will allow. In a limiter with a 100-watt setting, where the lamp resistance will pass only 80 watts on a short circuit, it will be seen that the amount of current passed through an iron, for instance, will be insufficient even to warm it. A further advantage is that on mild short circuits the limiter sometimes operates without blowing the main fuses, but even in the case of bad shorts the limiter tends to operate and provides an additional break, thus making the blowing of the fuses very much less destructive than would otherwise be the case.

As will be seen from the illustration (fig. 3), the limiter proper consists of a U-shaped laminated yoke (A), containing a main series coil (B), on each leg, and having a laminated armature (C) pivoted at one end below it. Below the armature is pivoted a further arm of fibre (D) which is normally held to the main armature by a hooked member (E) catching into a pin in the fibre (D). The main armature (C) carries one contact and the fibre arm the other, and the contacts (which are provided with carbon breaks) normally short-circuit the lamp resistance (F). When the predetermined current is exceeded, the main armature (C) is attracted to the yoke (A), and carries with it the fibre arm (D) since they are hooked together. When the main armature (C) has completed its travel, however, one end of the hooked member (E) impinges on a stop screw (G), and releases the fibre arm (D) which, consequently, drops away and thus relieves the short on the lamp resistance (F). This puts the latter in series with the load and dims all the lamps in circuit. Below the fibre arm (D) will be noted a further stop screw (H) and this, together with the screw (G), is the only adjustment necessary; the adjustment of the limiter in fact is exceedingly simple, and can be carried out by practically inexperienced people quite readily. In addition to the limiting device proper, the case contains the lamp resistance (F), two single-pole fuses (J) and (K), a terminal board (L) (for connection on the loop-in system), and a sealing chamber (M) (for use where lead-covered paper-insulated cable is employed), as well as an earthing clamp (N). Therefore, the case contains absolutely all that is necessary in order to give service to a consumer. It is unnecessary for the supply authority to buy separately the limiter, the fuses, sealing chamber, &c., and to mount them all on a separate board and interconenct them; all supply authorities do not use the loop-in system, but at least one Corporation which uses this system in combination with the Ediswan limiting device states, we are informed, that it can by this means give service at one half pre-war cost, a result which should commend the limiter to serious consideration.

## NEW PATENTS APPLIED FOR, 1921.

**(NOT YET PUBLISHED.)**

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

16,194. "Bowls for reflected lighting." A. W. Bailey. June 13th.
16,205. "Electric resistance for regulating candle-power of electric incandescent lamps." G. J. Bjerre. June 13th.
16,221. "Electric accumulators." H. M. Genese. June 13th.
16,230. "Electric lighting device." H. J. Cohen (J. Nies). June 13th.
16,243. "Electric motors." British Thomson-Houston Co., Ltd., and F. H. Clough. June 13th.
16,271. "Interference tubes for phonographs and telephones." M. E. Wolvekamp. June 13th.
16,272. "Speed-governors for electric motors." F. G. Creed and Creed & Co., Ltd. June 13th.
16,283. "Electric calling devices." A. W. Whistlecroft. June 13th.
16,290. "Alternating-current power-transmission plants." K. v. Kando. June 13th. (Hungary, August 16th, 1918.)
16,294. "Device for testing high-tension sparking plugs, magnetos, and coils." F. Greenhalgh and J. J. Jennison. June 14th.
16,302. "Electrically-heated cooking-ovens." G. A. C. Thynne and H. S. Thynne. June 14th.
16,312. "Magneto-electric machines." F. Westwood. June 14th.
16,317. "Devices for preventing removal of electric incandescent lamps from their holders." H. Gresty. June 14th.
16,331. "Arrangement for operation from a distance of an overload switch." F. Krupp Akt.-Ges. June 14th. (Germany, August 20th, 1920.)
16,354. "Signalling devices." A. E. Harley-Mason. June 14th.
16,363. "Electrical signalling methods." F. E. Pernot. June 14th.
16,369. "Motor mechanism for automatic telephone systems, &c." T. Lenaghan. June 14th.
16,370. "Registering systems." T. Lenaghan. June 14th.
16,371. "Automatic telephone systems." T. Lenaghan. June 14th.
16,372. "Electrical time switches." E. Roe. June 14th.
16,388. "Telephone systems." L. Drouet and A. Thomas. June 14th. (France, June 16th, 1920.)
16,393. "Automatic maximum-current switches." Siemens-Schuckertwerke. June 14th. (Germany, June 15th, 1920.)
16,400. "Electric-light pendants." J. E. Barber, H. M. Burr and W. F. Merry. June 14th.
16,419. "Electric plug and socket connections." J. B. Tucker. June 14th.
16,425. "Electric resistances." S. G. Frost. June 15th.
16,429. "Electrically-operated diaphragm pump." E. G. Fiegehen. June 15th.
16,431. "Vulcanite accumulator boxes." L. Brown and C. Macintosh & Co., Ltd. June 15th.

## PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

### 1919.

29,526. "Galvanic batteries." A. O. Tate. November 26th, 1919. (United States, March 8th.) (140,052.)
29,527. "Dynamo-electric machines." L. J. Stephenson. October 10th, 1918. (135,861.)
29,538. "Electrically-driven motor." A. Lecorat. November 26th, 1919. (France, November 27th, 1918.) (135,863.)
30,063. "Windings of alternating-current dynamo-electric machines." British Thomson-Houston Co., Ltd., F. H. Clough and H. W. Taylor. December 2nd, 1919. (164,046.)
30,513. "Electric gas-filled lamps with glow discharge." F. Schroter. May 3rd, 1915. (136,175.)
31,815. "Incandescent electric lamps." L. A. de Becker. December 18th, 1919. (164,058.)
32,569. "Means for the production of sound by electro-magnetically-operated diaphragms." E. A. Graham. December 29th, 1919. (164,060.)
32,700. "Manufacture of galvanic elements." F. Bocker and A. Eichhoff. December 30th, 1919. (164,062.)

### 1920.

2,445. "Magneto-starters." J. F. Adye. January 26th, 1920. (164,069.)
4,905. "Apparatus for holding X-ray tubes." Siemens & Halske Akt.-Ges. December 28th, 1917. (139,192.)
5,055. "Audible and visual indicator for signalling purposes." E. L. Marley. February 19th, 1920. (164,083.)
5,208. "Electrically-controlled fastenings for doors and the like." H. Knispel and F. Gerbsch. February 20th, 1920. (164,085.)
5,433. "Electrically-heated device." Landers, Frary & Clark. June 11th, 1919. (144,610.)
5,434. "Electrically-heated device." Landers, Frary & Clark. August 11th, 1919. (149,645.)
5,438. "Electrically-heated utensil." Landers, Frary & Clark. August 18th, 1919. (149,933.)
5,669. "Sound-locating apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). February 25th, 1920. (164,091.)
5,728. "Receivers of high-frequency sound waves." M. I. Pupin. February 4th, 1918. (139,496.)
5,743. "Electric toasters." E. P. Taylor. February 25th, 1920. (164,093.)
5,987. "Construction of aerial masts for wireless telegraphy and the like." S. Moehl. February 27th, 1920. (164,100.)
6,055. "Electrically-driven blocks, hoists, and the like." J. Ogden. February 28th, 1920. (164,102.)
6,079. "Wireless telephony." W. T. Ditcham. February 28th, 1920. (164,105.)
6,117. "Electric trackless or railless tramway cars and electric transport wagons." G. A. Bishop and R. A. Chadwick. March 1st, 1920. (164,108.)
6,221. "Dynamo-electric machines." A. B. Field and Metropolitan-Vickers Electrical Co., Ltd. March 1st, 1920. (164,114.)
6,222. "Dry batteries." Burgess Battery Co. March 13th, 1919. (140,065.)
6,400. "Renewal of incandescent electric lamps." J. J. Russell. March 2nd, 1920. (164,131.)
6,591. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. Savin. March 4th, 1920. (164,135.)
6,693. "Metal contacts for electrical apparatus." M. S. Conner and S. Lyttlemore. March 5th, 1920. (164,142.)
6,855. "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. R. Carter and R. Mercer. March 6th, 1920. (164,147.)
6,856. "Arrangements for detecting and utilising vibratory movements." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. March 6th, 1920. (Addition to 138,966.) (164,148.)
6,875. "Automatic feeding-mechanism for use in machines for making incandescent lamp bases and the like." British Thomson-Houston Co., Ltd. (General Electric Co.). March 6th, 1920. (164,149.)
7,431. "Device for use in winding armature coils." J. A. Edley and J. Fleming. March 12th, 1920. (164,162.)
7,876. "Decorative insulating-composition." F. D. Bull. March 17th, 1920. (164,169.)
8,249. "Electron discharge devices." General Electric Co., B. S. Gossling and A. C. Bartlett. March 19th, 1920. (164,175.)
8,837. "Electric switches." L. Norton and L. J. Norton. March 26th, 1920. (164,185.)
9,083. "Electrically-heated incubator." W. J. Anderson. March 29th, 1920. (164,193.)
12,120. "Electricity meters." S. James & Chamberlain and Hookham, Ltd. May 1st, 1920. (164,215.)
12,345. "Thermostatic apparatus." J. Kiell and W. Moon (legal representatives of C. E. Hearson, deceased). May 4th, 1920. (164,216.)
12,523. "Electrical contact-makers for use with the steering-wheels of motor-vehicles." J. L. Scott. May 5th, 1920. (Addition to 134,973.) (164,217.)
13,262. "Galvanic batteries." Fullers' United Electric Works, Ltd., and L. Fuller. May 13th, 1920. (164,221.)
13,487. "Electric distributing systems." F. A. Ross. May 17th, 1920. (164,225.)
13,552. "Spark plugs." A. H. Glassman and J. Bartha. May 17th, 1920. (164,226.)
15,205. "Galvanic batteries." G. Oldham and J. Oldham. June 4th, 1920. (164,235.)
15,857. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). June 11th, 1920. (Addition to 151,140). (164,239.)
16,154. "High-frequency electrical signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). June 15th, 1920. (164,242.)
16,235. "Sparking-plugs for internal-combustion engines." G. B. Sykes. June 16th, 1920. (164,243.)
17,179. "Telemotors." Amos & Smith, Ltd., and W. S. Hide. June 24th, 1920. (164,253.)
17,997. "Electric stoves." L. C. Eddy. December 4th, 1916. (145,705.)
21,150. "Sparking plugs." T. S. Price. July 13th, 1920. (164,261.)
25,270. "Motor-cycle magneto drives." Soc. Anon. Des Establissements Ballot. September 2nd, 1919. (150,710.)
30,653. "Means for communicating between the vehicles of electrically-driven trains." J. Bethenod. January 3rd, 1920. (157,081.)

### 1921.

1,297. "Protective device for electrical circuits." R. Dreyer. January 12th, 1918. (157,376.)
7,817. "Induction regulator for mono- and polyphase-current circuit." Maschinenfabrik Oerlikon and J. Kristen. March 23rd, 1920. (160,774.)
8,974. "Electricity meters." W. Lawson. July 31st, 1920. (Divided application on 162,702.) (164,293.)
10,065. "Electric relays systems and apparatus." E. A. Sperry. November 13th, 1914. (Divided application on 135,871.) (161,190.)